

**CARPENTER DEPO
EXHIBIT 1**

**UNITED STATES DISTRICT COURT
DISTRICT OF MAINE**

ED FRIEDMAN)	
)	
)	
Plaintiff,)	
)	CIVIL ACTION
v.)	
)	Case No. 20-cv-00237-JDL
CENTRAL MAINE POWER)	
COMPANY,)	
)	
Defendant.)	

NOTICE TO TAKE ORAL DEPOSITION OF DAVID O. CARPENTER, M.D.

TO: David O. Carpenter, M.D.

c/o William Most, Esq.
Law Offices of William Most
201 St. Charles Avenue
New Orleans, LA 70170

c/o Bruce M. Merrill, Esq.
225 Commercial Street, Suite 501
Portland, ME 04101

Please take notice that on Thursday, January 13, 2022, via the online platform Zoom, Defendant in the above-entitled action will take the deposition of David O. Carpenter, M.D., beginning at 10:00 a.m., upon oral examination pursuant to the Federal Rules of Civil Procedure, before The Reporting Group, or some other officer duly authorized by law to administer oaths, and will be recorded stenographically.

The deponent is requested to produce for inspection and copying at the deposition the following documents:

1. A current curriculum vitae;
2. Any and all documents reviewed, referred to, or relied upon by the deponent in forming his opinion in regards to the above-captioned matter;

3. Any and all documents reviewed, referred to, or relied upon by the deponent in forming the opinions to which he testified before the Maine Public Utilities Commission in the case bearing Docket No. 2011-262.

4. All documents reflecting communications between the deponent and Ed Friedman or his counsel during the pendency of the Maine Public Utilities Commission case bearing Docket No. 2011-262.

5. Any and all documents including but not limited to any reports, prepared or created by the deponent, in regards to the above-captioned matter.

6. A list of all publications authored by the deponent within the past ten years.

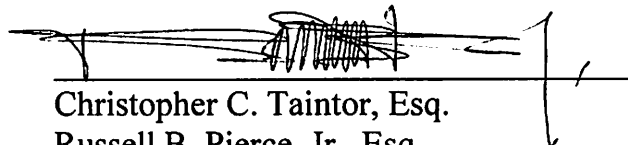
7. A list of all cases in which the deponent has testified as an expert witness within the past ten years.

8. All documents pertaining to any charges or payments for the services of the deponent as an expert witness in this case.

You are invited to attend and cross-examine.

Please provide The Reporting Group with your contact information and email address so that an email invitation can be sent to you and/or your representatives a link to Zoom to participate in this deposition. The Reporting Group can be reached at (207) 281-4230 or thereportinggroupmaine@gmail.com.

Dated at Portland, Maine this 5th day of January, 2022.



Christopher C. Taintor, Esq.
Russell B. Pierce, Jr., Esq.
Attorneys for Defendant
Central Maine Power

NORMAN, HANSON & DeTROY
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Portland, Maine 04112-4600
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ctaintor@nhdlaw.com

**DAVID CARPENTER
EXHIBIT A**

CURRICULUM VITAE

Name: David O. Carpenter

Home Address: 2749 Old State Road
Schenectady, New York 12303

Positions Held:
Director, Institute for Health and the Environment
University at Albany
Professor, Environmental Health Sciences
School of Public Health, University at Albany
5 University Place, A217, Rensselaer, NY 12144

Honorary Professor
Queensland Children's Medical Research Institute
University of Queensland
Brisbane, Australia

Education: 1959 B.A., Harvard College, Cambridge, MA
1964 M.D., Harvard Medical School, Boston, MA

Positions Held:

9/61-6/62 Research Fellow, Department of Physiology, University of Göteborg, Sweden with Professor Anders Lundberg

7/64-6/65 Research Associate, Department of Physiology, Harvard Medical School, Boston, MA under the direction of Dr. Elwood Henneman

7/65-2/73 Neurophysiologist, Laboratory of Neurophysiology, National Institutes of Mental Health, Dr. Edward V. Evarts, Chief, Assistant Surgeon, USPHS, currently a Reserve Officer in the USPHS.

2/73-3/80 Chairman, Neurobiology Department Armed Forces Radiobiology Research Institute, Defense Nuclear Agency, Bethesda, MD

3/80-9/85 Director, Wadsworth Center for Laboratories and Research, New York State Department of Health, Albany, NY

9/85-1/98 Dean, School of Public Health, University at Albany

9/85-Pres. Professor, Departments of Environmental Health Sciences and Biomedical Sciences, School of Public Health, University at Albany.

9/85-7/98 Research Physician, Wadsworth Center for Laboratories and Research, New York State Department of Health, Albany, NY

1/98-1/05 Adjunct Professor in the Center for Neuropharmacology & Neuroscience, Albany Medical College, Albany, NY

2001-Pres. Director, Institute for Health and the Environment, University at Albany, SUNY, Rensselaer, NY. The Institute was named a Collaborating Center of the World Health Organization in 2011.

2005-Pres. Senior Fellow, Alden March Bioethics Institute, Albany Medical College/Center, Albany, New York

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Editor-in-Chief: Cellular and Molecular Neurobiology, 1981 – 1987
Editor-in Chief: Reviews on Environmental Health 2012-present
Editor-in-Chief: Journal of Local and Global Health Sciences 2012-present
Editorial Advisor: Cellular and Molecular Neurobiology, 1987 - Present
Editorial Boards: Journal of Public Health Management and Practice, 1995 - 2002
International Journal of Occupational Medicine & Environmental Health
1996 – Present
Journal of Alzheimer's Disease – Associate Editor, 2007-2009
Reviews in Environmental Health; 2008-2012
International Archives of Occupational and Environmental Health; 2009-present.
Journal of Environmental and Public Health, 2009-present.
Environmental Health Perspectives, 2010-present
Global Health Perspective, 2012-present

National and International Committees:

1978, 1981 Physiology Study Section (Ad hoc member)
1979-1985 NIH International Fellowship Study Section
1974-1981 Member, Steering Committee of the Section on the Nervous System, American Physiological Society (Chairman of the Committee, 9/76-4/80)
1981-1989 Member, USA National Committee for the International Brain Research Organization
1985-1986 Committee on Electric Energy Systems of the Energy Engineering Board, National Research Council
1986-1987 Member, Neurophysiology Peer Panel for the National Aeronautics and Space Administration
1987-1989 Member, Science Advisory Council of the American Paralysis Association
1987-1990 Advisory Panel for the Electric Energy System Division, U.S. Department of Energy
1985-1993 Committee #79, National Council on Radiation Protection and Measurements
1986-1997 Member, Legislative and Education Committees, Association of Schools of Public Health
1989-1994 Member, Neuroscience Discipline Working Group, Life Sciences Division of the NASA
1994, 1995 Federation of American Societies for Experimental Biology Consensus Conference on FY 1995 Federal Research Funding
1994-1997 Member, Legislative Committee of the Association of Schools of Public Health
1997 Member, Executive Committee of the Association of Schools of Public Health
1997-2000 National Advisory Environmental Health Sciences Council of the National Institutes of Health
1998-Pres. Member, U.S. Section of the Great Lakes Science Advisory Board of the International Joint Commission
2000-Pres. Member, Board of Directors, Pacific Basin Consortium for Hazardous Waste Health and Environment; Treasurer, 2001-2004, 2008-pres; Chair, 2004-2008
2001-2008 United States Co-Chair, Workgroup on Ecosystem Health of the Science Advisory Board of the International Joint Commission
2002-2003 Member, Committee on the Implications of Dioxin in the Food Supply, The National Academies, Institute of Medicine
2003-2008 Member, United States Environmental Protection Agency, Children's Health Protection Advisory Committee
2003-Pres. Chair, Advisory Committee to the World Health Organization and National Institute of Environmental Health Sciences on collaborative activities.
2004-Pres. Member, Blue Ocean Institute Curriculum Advisory Board.
2007-2011 Chair, Workgroup on Risks vs. Benefits of Fish Consumption, Science Advisory Board, International Joint Commission.

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State and Local Committees:

1980-1987	Executive Secretary, New York State Power Lines Project
1985-1989	Board of Scientific Advisors, Institute of Basic Research, OMRDD, N.Y.
1986-1989	Member, Steering Committee, Health Policy and Administrative Consortium of the Capital District
1991-1992	Member, Connecticut Academy of Sciences and Engineering Committee on Electromagnetic Field Health Effects
1991-1992	Member, Board of Directors of the Capital District Chapter of the Alzheimer's Disease and Related Disorders Association, Inc.
1991-1992	Member, State Task Force for the Reform of Middle Level Education in NY State
1992-1993	Member, State Needs Task Force on Health Care and Education
1987-1998	Delegate-at-Large, New York State Public Health Association
1991-1995	Member, Board of Directors of the Capital District Amyotrophic Lateral Sclerosis Association
1994	Chair, Council of Deans, University at Albany, SUNY
1997-2008.	Member, Board of Directors, (Chair 1998-2004) Albany-Tula Inc.: A Capital Region Alliance
2000-Pres.	Member, Board of Directors, Healthy Schools Network, Inc.
2000-2003	Member, Medical Advisory Board, Hepatitis C Coalition, New York
2000-2004	Member, Environmental Protection Agency /National Association of State Universities and Land Grant Colleges Task Force
2001-2008	Member, Board of Directors, Environmental Advocates of New York
2004-2007	Member, Ad Hoc Advisory Group on Brownfield Cleanup Standards
2005-Pres.	Member, Schooling Chefs Curriculum Advisory Board
2005-Pres.	Member, Advisory Board, Healthy Child Healthy World
2005-2008	Member, Board of Directors, Citizens Environmental Coalition
2006-2009	Member, Board of Directors, Marine Environmental Research Institute
2007-2009	Member, New York State Renewable Energy Task Force

Honors, Awards and Fellowships:

1959	B.A. awarded <u>magna cum laude</u> . Thesis entitled "Metamorphosis of visual pigments: A study of visual system of the salamander, <u>Ambystoma tigrinum</u> " (Thesis advisor, Professor George Wald) Elected to Phi Beta Kappa and to Sigma Xi
1964	M.D. awarded <u>cum laude</u> for a thesis in a special field. Thesis entitled "Electrophysiological observations on the importance on neuron size in determining responses to excitation and inhibition in motor and sensory systems" (Thesis advisor, Dr. Elwood Henneman)
1964	Awarded the Leon Resnick Prize given to a Harvard Medical School graduate showing promise in research
1970	Awarded the Moseley Traveling Fellowship for study in England (Fellowship declined)
1971	Invited as Visiting Professor of Physiology, Centro de Investigacion y de Estudios Avanzados, del Institute Politecnico Nacional, Mexico 14, D.F., Mexico, for 3 months
1982, 1986	Visiting Professor of Physiology, Department of Physiology, Kyushu
1987	University, Fukuoka, Japan, for a period of three months each
1989	Awarded Jacob Javits Neuroscience Investigator Award from the National Institute of Neurological and Communicative Diseases and Stroke
1999	Awarded Homer N. Calver Award from the American Public Health Association for studies

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- in environmental health.
- 2001 Awarded 2001 Academic Laureate from the University at Albany Foundation.
- 2010 Awarded the Albion O. Bernstein, M.D. Award in recognition of an outstanding contribution to public health and the prevention of disease through lifelong research of environmental health hazards and for limitless devotion to medical education by the Medical Society of the State of New York.
- 2011 Awarded the Rodney Wylie Eminent Visiting Fellowship 2011 at the University of Queensland, Brisbane, Australia for a period of four weeks.

Federal Grants Held: (Principal Investigator Only)

- 1980-1983 United States Air Force, "Mechanisms of Radiation-Induced Emesis in Dogs", \$76,847 total direct costs.
- 1982-1988 National Institute of Health, "Mechanisms of Desensitization at Central Synapses", \$464,786 total direct costs.
- 1984-1986 Defense Nuclear Agency, "Mechanisms of Radiation-Induced Emesis in Dogs", \$330,504 total direct costs.
- 1986-1996 National Institute of Health, "Mechanisms of Excitatory Amino Acids Actions and Toxicity", 1986-1989 \$231,848 total direct costs; 1990-1996 \$562,926 total direct costs.
- 1989-1993 National Institute of Health, "Mechanisms of Lead Neurotoxicity" \$373,576 total direct costs
- 1990-1995 National Institute of Environmental Health Sciences, Superfund Basic Research Program, "Multidisciplinary Study of PCBs and PCDFs at a Waste Site", D.O. Carpenter, P.I. \$5,783,419 total direct costs.
- 1995-2001 Fogarty International Center, National Institutes of Health, International Training Program in Environmental and Occupational Health. A Central/Eastern European Environ/Occup Training Program, D.O. Carpenter, P.I. \$657,520 total costs.
- 1995-2001 National Institute of Environmental Health Sciences, Superfund Basic Research Program, "Multidisciplinary Study of PCBs," D.O. Carpenter, P.I. \$12,653,709 total direct costs.
- 1998-1999 Environmental Protection Agency, A Indoor Air Risk at Akwesasne - Pilot Project, D.O. Carpenter, P.I. \$9,996 total costs.
- 2000-2002 Association Liaison Office for University Cooperation in Development, A Cooperative Program in Environmental Health between the Institute of Public Health at Makerere University, Kampala, Uganda and the School of Public Health, University at Albany, USA, D.O. Carpenter, P.I. \$96,432 total costs.
- 2001-2007 Fogarty International Center, National Institutes of Health, International Training Program in Environmental and Occupational Health. A Multidisciplinary Environmental Health Training, D.O. Carpenter, P.I. \$850,000 total costs.
- 2006-2011 Pakistan-US Science and Technology Cooperative Program (US National Academy of Sciences). "Association of particulate matter with daily morbidity in an urban population," D.O. Carpenter, P.I., \$391,104 total costs.
- 2009-2013 Exploratory Center on Minority Health and Health Disparities in Smaller Cities. Project 2: Environmental contaminants and reproductive health of Akwesasne Mohawk women.

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\$387,825 for year 1. D.O. Carpenter, Co-PI.

- 2010-2013 Department of the Army, "Gulf War Illness: Evaluation of an Innovative Detoxification Program: D.O. Carpenter, P.I., \$636,958 total costs.
- 2010-2013 Higher Education for Development of the United States Agency for International Development, "Drinking Water Supply, Sanitation, and Hygiene Promotion : Health Interventions in Two Urban Communities of Kampala City and Mukono Municipality, Uganda". D. O. Carpenter, P.I., \$299,736 total costs.
- 2011-2016 National Institute of Environmental Health Sciences (1R01ES019620), "Protecting the health of future generations: Assessing and preventing exposures." PK Miller, FA von Hippel, CL Buck and DO Carpenter, Co-P.I.s, \$471,521 for the period 8/08/11-4/30/12, \$2,354,871 for the period 2011-2016.

Research Interests:

- Exposure to persistent organic pollutants and risk of diabetes, cardiovascular disease, and hypertension.
- Cognitive and behavioral effects of environmental contaminants on children (IQ, ADHD) and older adults (dementias, Parkinson's Disease and ALS).
- Ionizing and non-ionizing radiation biology.
- Effects of air pollution on respiratory and cardiovascular function.

Other Professional Activities:

Host, The Public Radio Health Show (a 30 min public health information show carried on 170+ stations nationwide), plus the Armed Forces Radio Network and Voice of America, 1985-2001.

Authored a biweekly health column in The Troy Record, a local newspaper, 1997-1999.

Major Peer-Reviewed Publications:

1. Carpenter, D.O., Lundberg, A. and Norrsell, U. Effects from the pyramidal tract on primary afferents and on spinal reflex actions to primary afferents. Experientia, 18:337, 1962.
2. Carpenter, D.O., Engberg, I. and Lundberg, A. Presynaptic inhibition in the lumbar cord evoked from the brain stem. Experientia, 18:450, 1962.
3. Carpenter, D.O., Lundberg, A. and Norrsell, U. Primary afferent depolarization evoked from the sensorimotor cortex. Acta Physiol. Scand., 59:126-142.
4. Carpenter, D.O., Engberg, I., Funkenstein, H. and Lundberg, A. Decerebrate control of reflexes to primary afferents. Acta Physiol. Scand., 59:424-437, 1963.
5. Carpenter, D.O., Engberg, I. and Lundberg, A. Differential supraspinal control of inhibitory and excitatory actions from the FRA to ascending spinal pathways. Acta Physiol. Scand., 63:103-110, 1965.
6. Henneman, E., Somjen, G.G. and Carpenter, D.O. Excitability and inhibibility of motoneurons of different sizes. J. Neurophysiol., 28:599-620, 1965.

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7. Henneman, E., Somjen, G.G. and Carpenter, D.O. Functional significance of cell size in spinal motoneurons. J. Neurophysiol., 28:560-580, 1965.
8. Somjen, G.G., Carpenter, D.O. and Henneman, E. Selective depression of alpha motoneurons of small size by ether. J. Pharmacol., 148:380-385, 1965.
9. Somjen, G., Carpenter, D.O. and Henneman, E. Response of motoneurons of different sizes to graded stimulation of supraspinal centers of the brain. J. Neurophysiol., 28:958-965, 1965.
10. Carpenter, D.O., Engberg, I. and Lundberg, A. Primary afferent depolarization evoked from the brain stem and the cerebellum. Arch. Ital. Biol., 104:73-85, 1966.
11. Carpenter, D.O. and Henneman, E. A relation between the threshold of stretch receptors in skeletal muscle and the diameter of axons. J. Neurophysiol., 29:353-368, 1966.
12. Carpenter, D.O. Temperature effects on pacemaker generation, membrane potential, and critical firing threshold in Aplysia neurons. J. Gen. Physiol., 50:1469-1484, 1967.
13. Chase, T.N., Breese, G., Carpenter, D., Schanberg, S. and Kopin, I. Stimulation-induced release of serotonin from nerve tissue. Adv. Pharmacol., 6A:351-364, 1968.
14. Carpenter, D.O. and Alving, B.O. A contribution of an electrogenic Na⁺ pump to membrane potential in Aplysia neurons. J. Gen. Physiol., 52:1-21, 1968.
15. Olson, C.B., Carpenter, D.O. and Henneman, E. Orderly recruitment of muscle action potentials. Arch. Neurol., 19:591-597, 1968.
16. Carpenter, D.O. Membrane potential produced directly by the Na⁺ pump in Aplysia neurons. Comp. Biochem. Physiol., 35:371-385, 1970.
17. Carpenter, D.O. and Gunn, R. The dependence of pacemaker discharge of Aplysia neurons upon Na⁺ and Ca⁺⁺. J. Cell. Physiol., 75:121-127, 1970.
18. Kraus, K.R., Carpenter, D.O. and Kopin, I. R. Acetylcholine-induced release of norepin-ephrine in the presence of tetrodotoxin. J. Pharmacol. Exp. Therap., 73:416-421, 1970.
19. Barker, J.L. and Carpenter, D.O. Thermosensitivity of neurons in the sensorimotor cortex of the cat. Science, 169:597-598, 1970.
20. Carpenter, D.O., Hovey, M.M. and Bak, A. Intracellular conductance of Aplysia neurons and squid axon as determined by a new technique. Intl. J. Neurosci., 2:35-48, 1971.
21. Carpenter, D.O., Breese, G., Schanberg, S. and Kopin, I. Serotonin and dopamine: Distribution and accumulation in Aplysia nervous and non-nervous tissues. Int. J. Neurosci., 2:49-56, 1971.
22. Hovey, M.M., Bak, A.F. and Carpenter, D.O. Low internal conductivity of Aplysia neuron somata. Science, 176:1329-1331, 1972.
23. Carpenter, D.O. Electrogenic sodium pump and high specific resistance in nerve cell bodies of the squid. Science, 179:1336-1338, 1973.
24. Carpenter, D.O. and Rudomin, P. The organization of primary afferent depolarization in the isolated spinal cord of the frog. J. Physiol. (Lond.), 229:471-493, 1973.
25. Shain, W., Green, L.A., Carpenter, D.O., Sytkowski, A.J. and Vogel, Z. Aplysia acetylcholine receptors: Blockage by and binding of α -bungarotoxin. Brain Res., 72:225-240, 1974.
26. Pierau, Fr.-K., Torrey, P. and Carpenter, D.O. Mammalian cold receptor afferents: Role of an electrogenic sodium pump in sensory transduction. Brain Res., 73:156-160, 1974.
27. Saavedra, J.M., Brownstein, M.J., Carpenter, D.O. and Axelrod, J. Octopamine: Presence in single neurons in Aplysia suggests neurotransmitter function. Science, 185:364-365, 1974.

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28. Willis, J.A., Gaubatz, G.L. and Carpenter, D.O. The role of the electrogenic sodium pump in modulation of pacemaker discharge of Aplysia neurons. J. Cell. Physiol., 84:463-472, 1974.
29. Brownstein, M.J., Saavedra, J.M., Axelrod, J., Zeman, G.H. and Carpenter, D.O. Coexistence of several putative neurotransmitters in single identified neurons of Aplysia. Proc. Natl. Acad. Sci. (USA), 71:4662-4665, 1975.
30. Carpenter, D.O. and Gaubatz, G.L. Octopamine receptors on Aplysia neurons mediate hyperpolarization by increasing membrane conductance. Nature, 252:483-485, 1974.
31. Pierau, Fr.-K., Torrey, P. and Carpenter, D.O. Afferent nerve fiber activity responding to temperature changes of the scrotal skin of the rat. J. Neurobiol., 38:601-612, 1975.
32. Carpenter, D.O. and Gaubatz, G.L. H₁ and H₂ histamine receptors on Aplysia neurons. Nature, 254:343-344, 1975.
33. Carpenter, D.O., Hovey, M.M. and Bak, A.F. Resistivity of axoplasm. II. Internal resistivity of giant axons of squid and Myxicola. J. Gen. Physiol., 66:139-148, 1975.
34. Zeman, G.H. and Carpenter, D.O. Asymmetric distribution of aspartate in ganglia and single neurons of Aplysia. Comp. Biochem. Physiol., 52C:23-26, 1975.
35. Pierau, Fr.-K., Torrey, P. and Carpenter, D.O. Effect of ouabain and potassium-free solution on mammalian thermosensitive afferents in vitro. Pflugers Arch., 359:349-356, 1975.
36. Swann, J.W. and Carpenter, D.O. The organization of receptors for neurotransmitters on Aplysia neurons. Nature, 258:751-754, 1975.
37. Yarowsky, P.J. and Carpenter, D.O. Aspartate: distinct receptors on Aplysia neurons. Science, 192:806-809, 1976.
38. Foster, K.R., Bidinger, J.M. and Carpenter, D.O. The electrical resistivity of aqueous cytoplasm. Biophys. J., 16:991-1001, 1976.
39. Carpenter, D.O., Greene, L.A., Shain, W. and Vogel, Z. Effects of eserine and neostigmine on the interaction of α -bungarotoxin with Aplysia acetylcholine receptors. Mol. Pharmacol., 12:999-1006, 1976.
40. Saavedra, J.M., Ribas, J., Swann, J. and Carpenter, D.O. Phenylethanolamine: A new putative neurotransmitter in Aplysia. Science, 195:1004-1006, 1977.
41. Carpenter, D.O., Swann, J.W. and Yarowsky, P.J. Effect of curare on responses to different putative neurotransmitters in Aplysia neurons. J. Neurobiol., 8:119-132, 1977.
42. Yarowsky, P.J. and Carpenter, D.O. GABA mediated excitatory responses on Aplysia neurons. Life Sci., 20:1441-1448, 1977.
43. Willis, J.A., Myers, P.R. and Carpenter, D.O. An ionophoretic module which controls electroosmosis. J. Electrophysiol. Tech., 6:34-41, 1977.
44. Yarowsky, P.J. and Carpenter, D.O. Receptors for gamma-aminobutyric acid (GABA) on Aplysia neurons. Brain Res., 144:75-94, 1978.
45. Carpenter, D.O., Gaubatz, G., Willis, J.A. and Severance, R. Effects of irradiation of Aplysia pacemaker neurons with 20 MeV electrons. Rad. Res., 76:32-47, 1978.
46. Yarowsky, P.J. and Carpenter, D.O. A comparison of similar ionic responses to gamma-aminobutyric acid and acetylcholine. J. Neurophysiol., 41:531-541, 1978.
47. Blum, B., Aufer, C.R. and Carpenter, D.O. A head holder and stereotaxic device for the rattlesnake. Brain Res. Bull., 3:271-274, 1978.

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48. Swann, J.W., Sinback, C.N. and Carpenter, D.O. Dopamine-induced muscle contractions and modulation of neuromuscular transmission in Aplysia. Brain Res., 157:167-172, 1978.
49. Swann, J.W., Sinback, C.N. and Carpenter, D.O. Evidence for identified dopamine motor neurons to the gill of Aplysia. Neurosci. Lett., 10:275-280, 1978.
50. Kebabian, P.R., Kebabian, J.W. and Carpenter, D.O. Regulation of cyclic AMP in heart and gill of Aplysia by the putative neurotransmitters, dopamine and serotonin. Life Sci., 24:1757-1764, 1979.
51. Carpenter, D.O. Interchangeable association of neurotransmitter receptors with several ionophores. Brain Res. Bull., 4:149-152, 1979.
52. Pellmar, T.C. and Carpenter, D.O. Voltage-dependent calcium current induced by serotonin. Nature, 277:483-484, 1979.
53. Ruben, P.C., Swann, J.W. and Carpenter, D.O. Neurotransmitter receptors on gill muscle fibers and the gill peripheral nerve plexus in Aplysia. Canad. J. Physiol. Pharmacol., 57:1088-1097, 1979.
54. Pellmar, T.C. and Carpenter, D.O. Serotonin induces a voltage-sensitive calcium current in neurons of Aplysia californica. J. Neurophysiol., 44:423-439, 1980.
55. Parver, L.M., Auker, C. and Carpenter, D.O. Choroidal blood flow as a heat dissipating mechanism in the macula. Am. J. Ophthalmol., 89:641-646, 1980.
56. Mell, L.D., Jr. and Carpenter, D.O. Fluorometric determination of octopamine in tissue homogenates by high-performance liquid chromatography. Neurochem. Res., 5:1089-1096, 1980.
57. Braitman, D.J., Auker, C.R. and Carpenter, D.O. Thyrotropin-releasing hormone has multiple actions in cortex. Brain Res., 194:244-248, 1980.
58. Meszler, R.M., Auker, C.R. and Carpenter, D.O. Fine structure and organization of the infrared receptor relay, the lateral descending nucleus of the trigeminal nerve in pit vipers. J. Comp. Neurol., 196:571-584, 1981.
59. Auker, C.R., Parver, L.M., Doyle, T. and Carpenter, D.O. Choroidal blood flow: I. Ocular tissue temperature as a measure of flow. Arch. Ophthalmol., 100:1323-1326, 1982.
60. Parver, L.M., Auker, C., Carpenter, D.O. and Doyle, T. Choroidal blood flow: II. Reflexive control in the monkey. Arch. Ophthalmol., 100:1327-1330, 1982.
61. Hori, N., Auker, C.R., Braitman, D.J. and Carpenter, D.O. Lateral olfactory tract transmitter: Glutamate, aspartate or neither? Cell. Mol. Neurobiol., 1:115-120, 1981.
62. Scappaticci, K.A., Dretchen, K.L., Carpenter, D.O. and Pellmar, T.C. Effects of furosemide on neural mechanisms in Aplysia. J. Neurobiol., 12:329-341, 1981.
63. Pellmar, T.C. and Carpenter, D.O. Cyclic AMP induces a voltage-dependent current in neurons of Aplysia californica. Neurosci. Lett., 22:151-157, 1981.
64. Parver, L., Auker, C. and Carpenter, D.O. Stabilization of macular temperature: The stabilizing effect of the choroidal circulation on the temperature environment of the macula. Retina, 2:117-120, 1982.
65. Green, R.W. and Carpenter, D.O. Biphasic responses to acetylcholine in mammalian reticulospinal neurons. Cell. Molec. Neurobiol., 1:401-405, 1981.
66. Hori, N., Auker, C.R., Braitman, D.J. and Carpenter, D.O. Pharmacologic sensitivity of amino acid responses and synaptic activation of in vitro prepyriform neurons. J. Neurophysiol., 48:1289-1301, 1982.

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67. Slater, N.T. and Carpenter, D.O. Blockade of acetylcholine-induced inward currents in *Aplysia* neurons by strychnine and desipramine: effect of membrane potential. Cell. Molec. Neurobiol., 2:53-58, 1982.
68. Swann, J.W., Sinback, C.N., Pierson, M.G. and Carpenter, D.O. Dopamine produces muscle contractions and modulates motoneuron-induced contractions in *Aplysia* gill. Cell. Molec. Neurobiol., 2:291-308, 1982.
69. Swann, J.W., Sinback, C.N., Keabian, P.R. and Carpenter, D.O. Motoneurons which may utilize dopamine as their neurotransmitter. Cell. Molec. Neurobiol., 2:309-324, 1982.
70. Auker, C.R., Meszler, R.M. and Carpenter, D.O. Apparent discrepancy between single unit activity and ¹⁴C-deoxyglucose labelling in the optic tectum of the rattlesnake. J. Neurophysiol., 49:1504-1516, 1983.
71. Slater, N.T., Carpenter, D.O., Freedman, J.E. and Snyder, S.H. Vipoxin both activates and antagonizes three types of acetylcholine response in *Aplysia* neurons. Brain Res., 278:266-270, 1983.
72. French-Mullen, J.M.H., Hori, N., Nakanishi, H., Slater, N.T. and Carpenter, D.O. Assymmetric distribution of acetylcholine receptors and M channels on prepyriform neurons. Cell. Molec. Neurobiol., 3:163-182, 1983.
73. Carpenter, D.O., Briggs, D.B. and Strominger, N. Responses of neurons of canine area postrema to neurotransmitters and peptides. Cell. Molec. Neurobiol., 3:113-126, 1983.
74. Slater, N.T. and Carpenter, D.O. Blocking kinetics at excitatory acetylcholine responses on *Aplysia* neurons. Biophys. J., 45:24-25, 1984.
75. Chesnut, T.J. and Carpenter, D.O. Two-component desensitization of three types of responses to acetylcholine in *Aplysia*. Neurosci. Lett., 39:285-290, 1983.
76. Haas, H.L., Jeffreys, J.G.R., Slater, N.T. and Carpenter, D.O. Modulation of low calcium induced field bursts in the hippocampus by monoamines and cholinomimetics. Pflugers Arch., 400:28-33, 1984.
77. Parvar, L.M., Auker, C.R. and Carpenter, D.O. Choroidal blood flow. III. Reflexive control in human eyes. Arch. Ophthalmol., 101:1604-1606, 1983.
78. Slater, N.T., Haas, H.L. and Carpenter, D.O. Kinetics of acetylcholine-activated cation channel blockade by the calcium antagonist D-600 in *Aplysia* neurons. Cell. Molec. Neurobiol., 3:329-344, 1983.
79. McCreery, M.J. and Carpenter, D.O. Modulation of neuronal responses to L-glutamate in *Aplysia*. Cell. Molec. Neurobiol., 4:91-95, 1984.
80. Carpenter, D.O., Briggs, D.B. and Strominger, N. Peptide-induced emesis in dogs. Behav. Brain Res., 11:277-281, 1984.
81. French-Mullen, J.M.H., Hori, N. and Carpenter, D.O. N-methyl-D-aspartate and L-aspartate activate distinct receptors in prepyriform cortex. Cell. Molec. Neurobiol., 4:185-189, 1984.
82. Slater, N.T. and Carpenter, D.O. A study of the cholinolytic actions of strychnine using the technique of concentration jump relaxation analysis. Cell Molec Neurobiol 4:263-271,1984.
83. Slater, N.T., Hall, A.F. and Carpenter, D.O. Kinetic properties of cholinergic desensitization in *Aplysia* neurons. Proc. Roy. Soc. Lond. B., 223:63-78, 1984.
84. Akaike, N., Hattori, K., Oomura, Y. and Carpenter, D.O. Bicuculline and picrotoxin block gamma-aminobutyric acid-gated Cl⁻ conductance by different mechanisms. Experientia, 41:70-71, 1985.

**DAVID CARPENTER
EXHIBIT A**

85. Slater, N.T., Carpenter, D.O., Freedman, J.E. and Synder, S.H. Dual effects of the snake venom polypeptide vipoxin on receptors for acetylcholine and biogenic amines in *Aplysia* neurons. Neurosci., 14:723-733, 1985.
86. Mizuno, Y., Oomura, Y., Hori, N. and Carpenter, D.O. Action of vasopressin on CA1 pyramidal neurons in rat hippocampal slices. Brain Res., 309:241-246, 1984.
87. Slater, N.T., Hall, A.F. and Carpenter, D.O. Trifluoperazine and calcium antagonists accelerate cholinergic desensitization in *Aplysia* neurons. Brain Res., 329:275-279, 1985.
88. ffrench-Mullen, J.M.H., Koller, K., Zaczek, R., Coyle, J.T., Hori, N. and Carpenter, D.O. N-acetylaspartylglutamate: Possible role as the neurotransmitter of the lateral olfactory tract. Proc. Nat. Acad. Sci., 82:3897-3900, 1985.
89. Greene, R.W. and Carpenter, D.O. Actions of neurotransmitters on pontine medial reticular formation neurons of the cat. J. Neurophysiol., 54:520-531, 1985.
90. Hori, N., ffrench-Mullen, J.M.H. and Carpenter, D.O. Kainic acid responses and toxicity show pronounced Ca^{2+} dependence. Brain Res., 358:380-384, 1985.
91. Gaillard, W.D. and Carpenter, D.O. Spectra of neurotransmitter receptors and ionic responses on cerebral A and B neurons in *Aplysia californica*. Brain Res., 373:303-310, 1986.
92. Gaillard, W.D. and Carpenter, D.O. On the transmitter at the A-to-B cell in *Aplysia californica*. Brain Res., 373:311-315, 1986.
93. ffrench-Mullen, J.M.H., Hori, N. and Carpenter, D.O. A comparison on the effects of quinolinate and N-methyl-aspartate on neurons in rat piriform cortex. Neurosci. Lett., 63:66-70, 1986.
94. ffrench-Mullen, J.M.H., Hori, N. and Carpenter, D.O. Receptors for the excitatory amino acids on neurons in rat pyriform cortex. J. Neurophysiol., 55:1283-1294, 1986.
95. Slater, N.T., David, J.A. and Carpenter, D.O. Relaxation studies on the interaction of hexamethonium with acetylcholine-receptor channels in *Aplysia* neurons. Cell. Molec. Neurobiol., 6:191-211, 1986.
96. Leung, M.K., S.-Rozsa, K., Hall, A., Kuruvilla, S., Stefano, G.B. and Carpenter, D.O. Enkephalin-like substance in *Aplysia* nervous tissue and actions of leu-enkephalin on single neurons. Life Sci., 38:1529-34, 1986.
97. Slater, N.T., Filbert, M. and Carpenter, D.O. Multiple interactions of anticholinesterases with *Aplysia* acetylcholine responses. Brain Res., 375:407-412, 1986.
98. Carpenter, D.O. and Briggs, D.B. Insulin excites neurons of the area postrema and causes emesis. Neurosci. Lett., 68:85-89, 1986.
99. Carpenter, D.O., Briggs, D.B., Knox, A.P. and Strominger, N.L. Radiation-induced emesis in the dog: Effects of lesions and drugs. Rad. Res., 108:307-316, 1986.
100. Briggs, D.B. and Carpenter, D.O. Excitation of neurons in the canine area postrema by prostaglandins. Cell. Molec. Neurobiol., 6:421-426, 1986.
101. Chesnut, T.J., Carpenter, D.O. and Strichartz, G.R. Three effects of venom from *conus striatus* on the delayed rectifier potassium current of molluscan neurons. Toxicon, 25:267-278, 1987.
102. Yakushiji, T., Tokutomi, N., Akaike, N. and Carpenter, D.O. Agonists of GABA responses, studied using internally perfused frog dorsal root ganglion neurons. Neuroscience 22:1123-1133, 1987.
103. Akaike, N., Yakushiji, T., Tokutomi, N. and Carpenter, D.C. Multiple mechanisms of antagonism of GABA responses. Cell. Molec. Neurobiol., 7:97-103, 1987.

DAVID CARPENTER
EXHIBIT A

104. Hori, N., Galeno, T. and Carpenter, D.O. Responses of pyriform cortex neurons to excitatory amino acids: Voltage dependence, conductance changes and effects of divalent cations. Cell. Molec. Neurobiol., 7:73-90, 1987.
105. Oyama, Y., King, W.M. and Carpenter, D.O. Edrophonium-induced membrane current in single neurons physically isolated from Aplysia californica. Brain Res., 438:95-100, 1988.
106. Jahan-Parwar, B., S.-Rozsa, K., Salanki, J., Evans, M.L. and Carpenter, D.O. In vivo labeling of serotonin containing neurons by 5,7-dihydroxytryptamine in Aplysia. Brain Res., 426:173-178, 1987.
107. King, W.M. and Carpenter, D.O. Distinct GABA and glutamate receptors may share a common channel in Aplysia neurons. Neurosci. Lett., 82:343-348, 1987.
108. Carpenter, D.O., Briggs, D.B., Knox, A.P. and Strominger, N. Excitation of area postrema neurons by transmitters, peptides and cyclic nucleotides. J. Neurophysiol., 59:358-369, 1988.
109. Carpenter, D.O., Hall, A.F. and Rahmann, H. Exogenous gangliosides induce direct voltage and conductance changes on isolated neurons. Cell. Molec. Neurobiol., 8:245-250, 1988.
110. Hori, N., Carpenter, D.O. and Katsuda, N. Effect of acetylcholine on the pyramidal cell in the rat piriform cortex in vitro. Neurosciences, 13:172-174, 1987 (in Japanese).
111. Hori, N. and Carpenter, D.O. Excitatory amino acid receptors in piriform cortex do not show receptor desensitization. Brain Res., 457:350-354, 1988.
112. Allen, C.N., Brady, R., Swann, J., Hori, N. and Carpenter, D.O. N-methyl-D-aspartate (NMDA) receptors are inactivated by trypsin. Brain Res., 458:147-150, 1988.
113. Oyama, Y., Akaike, N. and Carpenter, D.O. Strychnine decreases the voltage-dependent Ca^{2+} current of both Aplysia and frog ganglion neurons. Cell. Molec. Neurobiol., 8:307-314, 1988.
114. Oyama, Y., King, W.M., Allen, C.N., Hori, N. and Carpenter, D.O. Characterization of an inward current elicited by edrophonium in physically isolated and internally perfused Aplysia neurons. Brain Res., 463:124-132, 1988.
115. Hori, N., Akaike, N. and Carpenter, D.O. Piriform cortex brain slices: Techniques for isolation of synaptic inputs. J. Neurosci. Methods, 25:197-208, 1988.
116. Oyama, Y., Evans, M.L., Akaike, N. and Carpenter, D.O. Electrophysiological detection of acetylcholinesterase activity using concentration clamp on physically isolated Aplysia neurons. Neuroscience Res., 6:174-180, 1988.
117. Tsuda, Y., Oyama, Y., Carpenter, D.O. and Akaike, N. Effects of Ca^{2+} on the transient outward current of single isolated Helix central neurones. Brit J. Pharmacol., 95:526-530, 1988.
118. Oyama, Y., Hori, N., Evans, M.L., Allen, C.N. and Carpenter, D.O. Electrophysiological estimation of the actions of acetylcholinesterase inhibitors on acetylcholine receptor and cholinesterase in physically isolated Aplysia neurones. Brit. J. Pharmacol., 96:573-582, 1989.
119. King, W.M. and Carpenter, D.O. Voltage-clamp characterization of Cl⁻ conductance gated by GABA and L-glutamate in single neurons of Aplysia. J. Neurophysiol., 61:892-899, 1989.
120. Evans, M.L. and Carpenter, D.O. Desensitization kinetics of a chloride acetylcholine response in Aplysia. Brain Res., 495:309-318, 1989.
121. Salanki, J., Evans, M.L. and Carpenter, D.O. Desensitization kinetics of a K⁺ acetylcholine response in Aplysia. Brain Res., 495:298-308, 1989.
122. Büsselberg, D., Evans, M.L., Rahmann, H. and Carpenter, D.O. Effects of exogenous ganglioside and cholesterol application on excitability of Aplysia neurons. Membrane Biochemistry, 8:19-26, 1989.

**DAVID CARPENTER
EXHIBIT A**

123. Carpenter, D. Neural mechanisms of emesis. Canad. J. Physiol. Pharmacol., 68:230-236, 1990.
124. Oyama, Y., Hori, N., Allen, C.N., and Carpenter, D.O. Influences of trypsin and collagenase on acetylcholine responses of physically-isolated single neurons of *Aplysia californica*. Cell. Molec. Neurobiol., 10:193-205, 1990.
125. Büsselberg, D., Evans, M.L., Rahmann, H., and Carpenter, D.O. Lead inhibits the voltage-activated calcium current of *Aplysia* neurons. Toxicol. Lett., 51:51-57, 1990.
126. Doi, N., Carpenter, D.O. and Hori, N. Differential effects of baclofen and GABA on rat piriform cortex pyramidal neurons *in vitro*. Cell. Molec. Neurobiol., 10: 559-564, 1991.
127. Büsselberg, D., Evans, M.L., Rahmann, H. and Carpenter, D.O. Zn^{2+} blocks the voltage activated calcium current of *Aplysia* neurons. Neurosci. Letts., 117:117-122, 1990.
128. Büsselberg, D., Carpenter, D.O., Sugita, M., Araki, S., Satake, M. and Rahmann, H. Effects of exogenous lipid application on excitability of *Aplysia* neurons. Biomed. Res., 11:77-86, 1990.
129. Evans, M.L., Kadan, M.J., Hartig, P.R. and Carpenter, D.O. Correlation of ^{125}I -LSD autoradiographic labelling with serotonin voltage clamp responses in *Aplysia* neurones. Synapse, 8:22-29, 1991.
130. S.-Rozsa, K., Stefano, G., Salanki, J. and Carpenter, D.O. Characterization of responses to enkephalins and FMRFamide on B neurons of the cerebral ganglion of *Aplysia*. Comp. Biochem. Physiol., 99C:403-412, 1991.
131. Büsselberg, D., Evans, M.L., Rahmann, H. and Carpenter, D.O. Lead and zinc block a voltage activated calcium channel of *Aplysia* neurons. J. Neurophysiol., 65:786-795, 1991.
132. Hori, N., Doi, N., Miyahara, S., Shinoda, Y. and Carpenter, D.O. Appearance of NMDA receptors triggered by anoxia independent of voltage *in vivo* and *in vitro*. Exp. Neurol., 112:304-311, 1991.
133. Büsselberg, D., Evans, M.L., Rahmann, H. and Carpenter, D.O. Effects of inorganic and triethyl lead and inorganic mercury on the voltage activated calcium channel of *Aplysia* neurons. NeuroToxicology, 12:733-744, 1991.
134. Evans, M.L., Büsselberg, D. and Carpenter, D.O. Pb^{2+} blocks calcium currents of cultured dorsal root ganglion cells. Neurosci. Letts., 129:103-106, 1991.
135. Kemenes, G., S.-Rozsa, K., Stefano, G. and Carpenter, D.O. Distinct receptors for leu- and met-enkephalin on the metacerebral giant cell of *Aplysia*. Cell. Molec. Neurobiol., 12:107-119, 1992.
136. Ayrapetyan, S.N. and Carpenter, D.O. Very low concentrations of acetylcholine and GABA modulate transmitter responses. NeuroReport 2:563-565, 1991.
137. Carpenter, D.O. and Hori, N. Neurotransmitter and peptide receptors on medial vestibular nucleus neurons. Ann. NY Acad. Sci., 656:668-686, 1992.
138. Hernadi, L., S.-Rozsa, K., Jahan-Parwar, B. and Carpenter, D.O. A topography and ultrastructural characterization of *in vivo* 5,7-dihydroxytryptamine-labelled serotonin-containing neurons in the central nervous system of *Aplysia californica*. Cell. Molec. Neurobiol., 12:317-326, 1992.
139. Carpenter, D.O., Fejtl, M., Ayrapetyan, S., Szarowski, D. and Turner, J.N. Dynamic changes in neuronal volume resulting from osmotic and sodium transport manipulations. Acta Biologica Hungarica, 43:39-48, 1992.
140. Ayrapetyan, S.N. and Carpenter, D.O. On the modulating effect of ultralow transmitter concentrations on the functional activity of the neuron membrane. J. Evol. Biochem. Physiol., 27:110-116, 1991.

**DAVID CARPENTER
EXHIBIT A**

141. Büsselberg, D., Michael, D., Evans, M.L., Carpenter, D.O. and Haas, H.L. Zinc (Zn^{2+}) blocks voltage gated calcium channels in cultured rat dorsal root ganglion cells. Brain Res., 593:77-81, 1992.
142. Matthews, M.R., Parsons, P.J. and Carpenter, D.O. Solubility of lead as lead (II) chloride in HEPES-Ringer and artificial seawater (Ca-ASW) solutions. NeuroToxicology, 14:283-290, 1993.
143. Hori, N., Büsselberg, D., Matthews, R., Parsons, P.J. and Carpenter, D.O. Lead blocks LTP by an action not at NMDA receptors. Exp. Neurol., 119: 192-197, 1993.
144. Büsselberg, D., Evans, M.L., Haas, H.L. and Carpenter, D.O. Blockade of mammalian and invertebrate calcium channels by lead. NeuroToxicology, 14:249-258, 1993.
145. Riepe, M., Hori, N., Ludolph, A.C., Carpenter, D.O., Spencer, P.S. and Allen, C.N. Inhibition of energy metabolism by 3-nitropropionic acid activates ATP-sensitive potassium channels. Brain Res., 586:61-66, 1992.
146. Hori, N., Hirotsu, I., Davis, P.J. and Carpenter, D.O. Long-term potentiation is lost in aged rats but preserved by calorie restriction. NeuroReport, 3:1085-1088, 1992.
147. Knox, A.P., Strominger, N.L., Battles, A.H. and Carpenter, D.O. Behavioral studies of emetic sensitivity in the ferret. Brain Res. Bull., 31:477-484, 1993.
148. Allen, C.N., Spencer, P.S. and Carpenter, D.O. β -N-methylamino-L-alanine in the presence of bicarbonate is an agonist at non-N-methyl-D-aspartate-type receptors. Neuroscience 54:567-574, 1993.
149. Elekes, K., Stefano, G.B. and Carpenter, D.O. Enkephalin-like immunoreactive neurons in the central nervous system of gastropods (*Helix pomatia*, *Lymnaea stagnalis*, *Aplysia californica*): A comparative immunocytochemical study. Cell Tiss. Res. 272:329-41, 1993.
150. Büsselberg, D., Platt, B., Haas, H.L. and Carpenter, D.O. Voltage gated calcium channel currents of rat dorsal root ganglion (DRG) cells are blocked by Al^{3+} . Brain Res. 622:163-168, 1993.
151. Strominger, N.L., Knox, A.P. and Carpenter, D.O. The connectivity of the area postrema in the ferret. Brain Res. Bull., 33:33-47, 1994.
152. Knox, A.P., Strominger, N.L., Battles, A.H. and Carpenter, D.O. The central connections of the vagus nerve in the ferret. Brain Res. Bull., 33:49-63, 1994.
153. Lin, Y. and Carpenter, D.O. Medial vestibular neurons are endogenous pacemakers whose discharge is modulated by neurotransmitters. Cell. Molec. Neurobiol., 13:601-613, 1993.
154. Kemenes, G., S.-Rózsa, K. and Carpenter, D.O. Cyclic-AMP-mediated excitatory responses to leucine enkephalin in *Aplysia* neurones. J. Exp. Biol. 181: 321-328, 1993.
155. Büsselberg, D., Platt, B., Michael, D., Carpenter, D.O. and Haas, H.L. Mammalian voltage-activated calcium channel currents are blocked by Pb^{2+} , Zn^{2+} and Al^{3+} . J. Neurophysiol., 71:1491-1497, 1994.
156. Hori, N. and Carpenter, D.O. Transient ischemia causes a reduction of Mg^{2+} blockade of NMDA receptors. Neurosci. Letts., 173:75-78, 1994.
157. Riepe, M.W., Hori, N., Ludolph, A.C. and Carpenter, D.O. Failure of neuronal ion exchange, not potentiated excitation, causes excitotoxicity after inhibition of oxidative phosphorylation. Neuroscience, 64:91-97, 1995.
158. Hori, N. and Carpenter, D.O. Functional and morphological changes induced by transient *in vivo* ischemia. Exp. Neurol., 129:279-289, 1994.
159. Lin, Y. and Carpenter, D.O. Direct excitatory opiate effects mediated by non-synaptic actions on rat medial vestibular neurons. Eur. J. Pharmacol., 262:99-106, 1994.

**DAVID CARPENTER
EXHIBIT A**

160. Carpenter, D.O. Epidemiological evidence for an association between exposure to 50 and 60 Hz magnetic fields and cancer. James Bay Publication Series, Hydro-Electric Development: Environmental Impacts - Paper No. 6, pp. 2-31, 1994.
161. Carpenter, D.O. Communicating with the public on issues of science and public health. Environ. Health Perspect. 103:127-130, 1995.
162. Fejtl, M., Gyori, J. and Carpenter, D.O. Hg^{2+} increases the open probability of carbachol-activated Cl^- channels in *Aplysia* neurons. NeuroReport, 5:2317-2320, 1994.
163. Carpenter, D.O. The public health significance of metal neurotoxicity. Cell. Molec. Neurobiol., 14:591-597, 1994.
164. Gyori, J., Fejtl, M. and Carpenter, D.O. Effect of $HgCl_2$ on acetylcholine, carbachol and glutamate currents of *Aplysia* neurons. Cell. Molec. Neurobiol., 14:653-664, 1994.
165. Fejtl, M., Gyori, J. and Carpenter, D.O. Mercuric (II) chloride modulates single channel properties of carbachol activated Cl^- channels in cultured neurons of *Aplysia californica*. Cell. Molec. Neurobiol., 14:665-674, 1994.
166. Carpenter, D.O., Matthews, M.R., Parsons, P.J. and Hori, N. Long-term potentiation in piriform cortex is blocked by lead. Cell. Molec. Neurobiol., 14:723-733, 1994.
167. Salanki, J., Gyori, J. and Carpenter, D.O. Action of lead on glutamate-activated chloride currents in *Helix Pomatia* L. neurons. Cell. Molec. Neurobiol., 14:755-768, 1994.
168. Carpenter, D.O. How hazardous wastes affect human health. Cent. Eur. J. Publ. Hlth. 2:6-9, 1994.
169. Oyama, Y., Carpenter, D.O., Ueno, S., Hayashi, H. and Tomiyoshi, F. Methylmercury induces Ca^{2+} -dependent hyperpolarization of mouse thymocytes: A flow-cytometric study using fluorescent dyes. Eur. J. Pharmacol., 293:101-107, 1995.
170. Fejtl, M., Szarowski, D.H., Decker, D., Buttle, K., Carpenter, D.O. and Turner, J.N. Three-dimensional imaging and electrophysiology of live *Aplysia* neurons during volume perturbation: confocal light and high-voltage electron microscopy. JMSA 1(2):75-85, 1995.
171. Carpenter, D.O., Kemenes, G., Elekes, K., Leung, M., Stefano, G., S.-Rozsa, K. and Salanki, J. Opioid peptides in the nervous system of *Aplysia*: A combined biochemical immunocytochemical, and electrophysiological study. Cell. Molec. Neurobiol. 15:239-256, 1995.
172. Riepe, M. and Carpenter, D.O. Delayed increase of cell volume of single pyramidal cells in live hippocampal slices upon kainate application. Neurosci. Letts. 191:35-38, 1995.
173. Son, H. And Carpenter, D.O. Protein kinase C activation is necessary but not sufficient for induction of LTP at the synapse of mossy fiber-CA3 in the rat hippocampus. Neuroscience 72:1-13, 1996.
174. Iwase, T., Hori, N., Morioka, T. and Carpenter, D.O. Low power laser irradiation reduces ischemic damage in hippocampal slices *in vitro*. Lasers Surg. Med., 19:465-450, 1996.
175. Carpenter, D.O., King, W.M. and McCreery, M.J. The role of glutamate reuptake in regulation of glutamate responses in *Aplysia* neurons. Acta Biologica Hungaria 46:363-373, 1995.
176. Saghian, A.A., Ayrapetyan, S.N. and Carpenter, D.O. Low concentrations of ouabain stimulate Na/Ca exchange in neurons. Cell. Molec. Neurobiol., 16:489-498, 1996.
177. Platt, B., Carpenter, D.O., Büsselberg, D., Reymann, K.G. and Riedel, G. Aluminum impairs hippocampal long-term potentiation in rats *in vitro* and *in vivo*. Exp. Neurol., 134:73-86, 1995.
178. Rubakhin, S.S., Gyori, J., Carpenter, D.O. and Salanki, J. $HgCl_2$ potentiates GABA activated currents in *Lymnaea stagnalis* L. neurons. Acta Biologica Hungaria, 46:431-444, 1995.

DAVID CARPENTER
EXHIBIT A

179. Fejtl, M. and Carpenter, D.O. Neurite outgrowth is enhanced by conditioning factor(s) released from central ganglia of *Aplysia californica*. Neurosci. Letts., 199:33-36, 1995.
180. Riepe, M.W., Niemi, W.N., Megow, D., Ludolph, A.C. and Carpenter, D.O. Mitochondrial oxidation in rat hippocampus can be preconditioned by selective chemical inhibition of SDH. Exp. Neurol., 138:15-21, 1996.
181. Son, H. and Carpenter, D.O. Interactions among paired-pulse facilitation and post-tetanic and long-term potentiation in the mossy fiber-CA3 pathway in rat hippocampus. Synapse, 23:302-311, 1996.
182. Carpenter, D.O., Suk, W.A., Blaha, K. and Cikrt, M. Hazardous wastes in Eastern and Central Europe. Environ. Health Perspect., 104:244-248, 1996.
183. Son, H., Davis, P.J. and Carpenter, D.O. Time course and involvement of protein kinase C-mediated phosphorylation of F1/GAP-43 in area CA3 after the mossy fiber stimulation. Cell. Molec. Neurobiol., 17:171-194, 1997.
184. Dyatlov, V.A., Platoshin, A.V., Lawrence, D.A. and Carpenter, D.O. Mercury (Hg^{2+}) enhances the depressant effect of kainate on Ca-inactivated potassium current in telencephalic cells derived from chick embryos. Toxicol. Appl. Pharmacol., 138:285-297, 1996.
185. Carpenter, D.O. and Conway, J.B. Optimizing professional education in public health. J. Public Health Management Practice, 2:66-72, 1996.
186. Carpenter, D.O. Great Lakes contaminants: A shift in human health outcomes. Health and Environment Digest, 10:17-19, 1996.
187. Boldyrev, A.A., Stvolinsky, S.L., Tyulina, O.V., Koshelev, V.B., Hori, N. and Carpenter, D.O. Biochemical and physiological evidence that carnosine is an endogenous neuroprotector against free radicals. Cell. Molec. Neurobiol., 17:259-271, 1997.
188. Szűcs, A., Angiello, C., Salánki, J. and Carpenter, D.O. Effects of inorganic mercury and methylmercury on the ionic currents of cultured rat hippocampal neurons. Cell. Molec. Neurobiol., 17:273-288, 1997.
189. Niemi, W.D., Slivinski, K., Audi, J., Rej, R. and Carpenter, D.O. Propylthiouracil treatment reduces long-term potentiation in area CA1 of neonatal rat hippocampus. Neurosci. Letts., 210:127-129, 1996.
190. Son, H., Madelian, V. and Carpenter, D.O. The translocation and involvement of protein kinase C in mossy fiber-CA3 long-term potentiation in hippocampus of the rat brain. Brain Res., 739:282-292, 1997.
191. Oyama, Y., Carpenter, D.O., Chikahisa, L. and Okazaki, E. Flow-cytometric estimation on glutamate- and kainate-induced increases in intracellular Ca^{2+} of brain neurons. Brain Research, 728:121-124, 1996.
192. Carpenter, D.O., Stoner, C.R.T. and Lawrence, D.A. Flow cytometric measurements of neuronal death triggered by PCBs. NeuroToxicology, 18:507-514, 1997.
193. Azatian, K.V., Ayrapetyan, S.N. and Carpenter, D.O. Metabotropic GABA receptors regulate acetylcholine responses on snail neurons. Gen. Pharmacol., 29:67-72, 1997.
194. Carpenter, D.O., Stoner, C.T., Lawrence, D.A., Niemi, W.D., Shain, W. and Seegal, R. Multiple mechanisms of PCB neurotoxicity. Proceedings of the 1996 Pacific Basin Conference on Hazardous Waste, Kuala Lumpur, Malaysia, CONF-9611157, pp. 404-918.
195. Carpenter, D.O. New Dimensions in our understanding of the human health effects of environmental pollutants. Proceedings of the 1996 Pacific Basin Conference on Hazardous Waste, Kuala Lumpur, Malaysia, CONF-9611157, pp. 37-53.

DAVID CARPENTER
EXHIBIT A

196. Carpenter, D.O. Possible effects of electromagnetic fields on the nervous system and development. Men. Retard. Dev. Dis. Res. Rev. 3:270-274, 1997.
197. Chiarenzelli, J., Scrudato, R., Bush, B., Carpenter, D. and Bushart, S. Do large-scale remedial and dredging events have the potential to release significant amounts of semi-volatile compounds to the atmosphere? Environ. Hlth. Perspect., 106:47-49, 1998.
198. Dyatlov, V.A., Dytlova O.M., Parsons, P.H., Lawrence, D.A. and Carpenter, D.O. Lipopolysaccharide and interleukin-6 enhance lead entry into cerebellar neurons: Application of a new and sensitive flow cytometric technique to measure intracellular lead and calcium concentrations. NeuroToxicology, 19:293-302, 1998.
199. Dyatlov, V.A., Platoshin, A.V., Lawrence, D.A. and Carpenter, D.O. Lead potentiates cytokine- and glutamate-mediated increases in permeability of the blood-brain barrier. NeuroToxicology, 19:283-292, 1998.
200. Niemi, W.D., Audi, J., Bush, B. and Carpenter, D.O. PCBs reduce long-term potentiation in the CA1 region of rat hippocampus. Exper. Neurol., 151:26-34, 1998.
201. Carpenter, D.O. Health effects of metals. Cent. Eur. J. Publ. Hlth., 6:160-163, 1998.
202. Carpenter, D.O., Bláha, K., Buekens, A., Cikrt, M., Damstra, T., Dellinger, B., Sarofim, A., Suk, W.A., Wyse, H. and Zejda, J. Remediation of hazardous wastes in Central and Eastern Europe: Technology and health effects. Cent. Eur. J. Publ. Hlth., 6:77-78, 1998.
203. Carpenter, D.O. Human health effects of environmental pollutants: New Insights. Environ. Monitor. Assess. J., 53:245-258, 1998.
204. Dyatlov, V.A., Makovetskaia, V.V., Leonhardt, R., Lawrence, D.A. and Carpenter, D.O. Vitamin E enhances Ca^{2+} -mediated vulnerability of immature cerebellar granule cells to ischemia. Free Rad. Biol. Med., 25: 793-802, 1998.
205. Fitzgerald, E.F., Schell, L.M., Marshall, E.G., Carpenter, D.O., Suk, W.A. and Zejda, J.E. Environmental pollution and child health in Central and Eastern Europe. Environ. Health Persp., 106:307-311, 1998.
206. Carpenter, D.O., Arcaro, K.F., Bush, B., Niemi, W.D., Pang, S. and Vakharia, D.D. Human health and chemical mixtures: An overview. Environ. Health Perspect., 106: 1263-1270, 1998.
207. Carpenter, D.O., Cikrt, M. and Suk, W.A. Hazardous wastes in Eastern and Central Europe: Technology and health effects. Environ. Health Perspect., 107: 3-4, 1999.
208. Carpenter, D.O. Polychlorinated biphenyls and human health. Int. J. Occup. Med. Environ. Hlth. 11: 291-303, 1998.
209. Boldyrev, A.A., Johnson, P., Yanzhang, W., Tan, Y. and Carpenter, D.O. Carnosine and taurine protect rat cerebellar granular cells from free radical damage. Neurosci. Letts., 263: 169-172, 1999.
210. Boldyrev, A.A., Carpenter, D.O., Huentelman, M.J., Peters, C.M. and Johnson, P. Sources of reactive oxygen species production in excitotoxin-stimulated neurons. Biophys. Biochem. Res. Commun., 256: 320-324, 1999.
211. Ayrapetyan, S.N., Ayrapetyan, G. and Carpenter, D.O. The electrogenic sodium pump activity in *Aplysia* neurons is not potential dependent. Acta Biologica Hungarica, 50: 27-34, 1999.
212. Boldyrev, A., Song, R., Lawrence, D. and Carpenter, D.O. Carnosine protects against excitotoxic cell death independently of effects on reactive oxygen species. Neuroscience, 94: 571-577, 1999.
213. Boldyrev, A., Song, R., Dyatlov, V.A., Lawrence, D.A. and Carpenter, D.O. Neuronal cell death and reactive oxygen species. Cell. Molec. Neurobiol., 20:433-450, 2000.

**DAVID CARPENTER
EXHIBIT A**

214. Gyori, J., Platoshyn, O., Carpenter, D.O. and Salanki, J. Effect of inorganic- and organic tin compounds on ACh- and voltage-activated Na currents. Cell. Molec. Neurobiol. 20:591-604, 2000.
215. Hussain, R.J., Gyori, J., DeCaprio, A.P. and Carpenter, D.O. *In vivo* and *in vitro* exposure to PCB 153 reduces long-term potentiation. Environ. Hlth. Perspect., 108 :827-831, 2000.
216. Negoita, S., Swamp, L., Kelley, B. and Carpenter, D.O. Chronic diseases surveillance of St. Regis Mohawk health service patients. J. Public Health Management Practice, 7:84-91, 2001.
217. Hussain, R.J., Parsons, P.J., Carpenter, D.O. Effects of lead on long-term potentiation in hippocampal CA3 vary with age. Dev. Brain Res., 121: 243-252, 2000.
218. Tanji, M., Katz, B.H., Spink, B.C. and Carpenter, D.O. Growth inhibition of MCF-7 cells by estrogen is dependent upon a serum factor. Anticancer Res., 20: 2779-2784, 2000.
219. Tanji, M. and Carpenter, D.O. A steroid-binding protein mediates estrogen-dependent inhibition of growth of MCF-7 breast cancer cells. Anticancer Res., 20:2785-2790, 2000.
220. Gyori, J., Hussain, R., Carpenter, D.O. Long-term potentiation in CA1 region of rat brain slices is blocked by PCB 153. Cent. Europ. J. Publ. Hlth., 8: 21-22, 2000.
221. Carpenter, D.O. Human health effects of polychlorinated biphenyls. Cent. Eur. J. Public Health, 8: 23-24, 2000.
- 221a. Sukdolova, V., Negoita, S., Hubicki, L., DeCaprio, A., and Carpenter, D.O. The assessment of risk to acquired hypothyroidism from exposure to PCBs: a study among Akwesasne Mohawk women. Cent. Eur. J. Public Health, 8: 167-168, 2000.
222. Carpenter, D.O., Chew, F.T., Damstra, T., Lam, L.H., Landrigan, P.J., Makalinao, I., Peralta, G.L. and Suk, W.A. Environmental threats to the health of children: The Asian perspective. Environ. Hlth. Perspect., 108: 989-992, 2000.
223. Boldyrev, A.A., Carpenter, D.O. and Johnson, P. Natural mechanisms of protection of neurons against oxidative stress. Recent Res. Devel. Comparative Biochem. & Physiol. 1: 91-103, 2000.
224. Strominger, N.L., Hori, N., Carpenter, D.O., Tan, Y. and Folger W.H. Effects of acetylcholine and GABA on neurons in the area postrema of *Suncus murinus* brainstem slices. Neurosci. Letts. 309: 77-80, 2001.
225. Strominger, N.L., Brady, R., Gullikson, G. and Carpenter, D.O. Imiquimod-elicited emesis is mediated by the area postrema, but not by direct neuronal activation. Brain Res. Bull. 55: 445-451, 2001.
226. Hori, N., Tan, Y., Strominger, N.L. and Carpenter, D.O. Intracellular activity of rat spinal cord motoneurons in slices. J. Neurosci. Meth. 112: 185-191, 2001.
227. Sukocheva, O.A., Abramov, A.Y., Levitskaya, J.O., Gagelgans, A.I. and Carpenter, D.O. Modulation of intracellular Ca concentration by vitamin B12 in rat thymocytes. Blood Cells. Mol. Dis. 27: 812-824, 2001.
228. Gilbertson, M., Carpenter, D. and Upshur, R. Methodology for assessing community health in Areas of Concern: Measuring the adverse effects on human health. Environ. Health Perspect. 109 (Suppl 6): 811-812, 2001.
229. Carpenter, D.O., Shen, Y., Nguyen, T., Le, L. and Lininger, L.L. Incidence of endocrine disease among residents of New York Areas of Concern. Environ. Health Perspect. 109: (Suppl 6) 845-851, 2001.
230. Suk, W.A., Carpenter, D.O., Cirk, M. and Smerhovsky, Z. Metals in Eastern and Central Europe: Health effects, sources of contamination and methods of remediation. Internat. J. Occup. Med. Environ. Health 14, 151-156, 2001.

**DAVID CARPENTER
EXHIBIT A**

231. Carpenter, D.O. Effects of metals on the nervous system of humans and animals. Internat. J. Occup. Med. Environ. Health 14: 209-218, 2001.
232. Carpenter, D.O., Arcaro, K. and Spink, D.C. Understanding the human health effects of chemical mixtures. Environ. Health Perspect. 110 (Suppl 1), 25-42, 2002.
233. Carpenter, D.O., Nguyen, T., Le, L., Kudyakov, R. and Lininger, L. Human disease in relation to residence near hazardous waste sites. Proceedings of The 10th Pacific Basin Conference on Hazardous Waste, Okayama, Japan, December 5-7, 2001.
234. Carpenter, D.O., Tarbell, A., Fitzgerald, E., Kadlec, M.J., O'Hehir, D.O. and Bush, B. University-community partnership for the study of environmental contamination at Akwesasne. In: Biomarkers of Environmentally Associated Disease, S.H. Wilson and W.A. Suk, editors, CRC Press/Lewis Publishers, 507-523, 2002.
235. Carpenter, D.O., Hussain, R.J., Berger, D.F., Lombardo, J.P., Park, H-Y. Electrophysiological and behavioral effects of perinatal and acute exposure of rats to lead and polychlorinated biphenyls. Environ. Health Perspect., 110: 377-386, 2002.
236. Hori, N., Tan, Y. King, M., Strominger, N.L. and Carpenter, D.O. Differential actions and excitotoxicity of glutamate agonists on motoneurons in adult mouse cervical spinal cord slices. Brain Res., 958: 434-438, 2002.
237. Laemle, L.K., Hori, N., Strominger, N.L., Tan, Y. and Carpenter, D.O. Physiological and anatomical properties of the suprachiasmatic nucleus of an anophthalmic mouse. Brain Res., 953: 73-81, 2002.
238. Hori, N., Tan, Y., Strominger, N.L. and Carpenter, D.O. Rat motoneuron cell death in development correlates with loss of N-methyl-D-aspartate receptors. Neurosci. Letts., 330:131-134, 2002.
239. Carpenter, D.O., Morris, D.L. and Legator, M. Initial attempts to profile health effects with types of exposure in Anniston, Alabama. FEB, 12: 191-195, 2003.
240. Carpenter, D.O., Nguyen, T., Le, L., Baibergenova, A. and Kudyakov, R. Profile of health effects related to proximity to PCB-contaminated hazardous waste sites in New York. FEB, 12: 173-180, 2003.
241. Hori, N., Carp, J.S., Carpenter, D.O. and Akaike, N. Corticospinal transmission to motoneurons in cervical spinal slices from adult rats. Life Sci., 72: 389-396, 2002.
242. Carpenter, D.O. and Hussain, R.J. Cell-to-cell communication of neurons is impaired by metals. Mat.-wiss. U. Werkstofftech. 34: 1-8, 2003.
243. Tan, Y., Hori, N. and Carpenter, D.O. The mechanism of presynaptic long-lasting-depression mediated by group 1 metabotropic glutamate receptors. Cell. Molec. Neurobiol., 23: 187-203, 2003.
244. Baibergenova, A., Kudyakov, R., Zdeb, M., and Carpenter, D.O. Low birth weight and residential proximity to PCB-contaminated waste sites. Environ. Health Perspect., 111: 1352-1357, 2003.
245. Nishizaki, Y., Oyama, Y., Sakai, Y., Hiram, S., Tomita, K., Nakao, H., Umebayashi, C., Ishida, S., Okano, Y. and Carpenter, D.O. PbCl₂-induced hyperpolarization of rat thymocytes: Involvement of charybdotoxin-sensitive K⁺ channels. Environ. Toxicol., 18(5): 321-326, 2003.
246. Hussain, R.J. and Carpenter, D.O. The effects of protein kinase C activity on synaptic transmission in two areas of rat hippocampus. Brain Res., 990: 28-37, 2003.
247. Suk, W.A., Ruchirawat, K., Balakrishnan, K., Berger, M., Carpenter, D., Damstra, T., Pronczuk de Garbino, J., Koh, D., Landrigan, P.J., Makalinao, I., Sly, P.D., Xu, Y. and Zheng, B.S. Environmental threats to children's health in Southeast Asia and the Western Pacific. Environ. Health Perspect. 111: 1340, 2003.

**DAVID CARPENTER
EXHIBIT A**

248. Carpenter, D.O. The need for global environmental health policy. New Solutions, 13(1): 53-59, 2003.
249. Tan, Y., Li, D., Song, R., Lawrence, D. and Carpenter, D.O. Ortho-substituted PCBs kill thymocytes. Toxicol. Sci., 76: 328-337, 2003.
250. Boldyrev, A., Bulygina, E., Carpenter, D.O. and Schoner, W. Glutamate receptors communicate with Na⁺/K⁺-ATPase in rat cerebellum granule cells: Demonstration of differences in the action of several metabotropic and ionotropic glutamate agonists on intracellular reactive oxygen species and the sodium pump. J. Molec. Neurosci., 21:213-222, 2003.
251. Hites, R.A., Foran, J.A., Carpenter, D.O., Hamilton, M.C., Knuth, B.A. and Schwager, S.J. Global assessment of organic contaminants in farmed salmon. Science 303: 226-229, 2004.
252. Sandal, S., Yilmaz, B., Chen, C-H and Carpenter, D.O. Comparative effects of technical toxaphene, 2,5-dichloro-3-biphenylol and octabromodiphenylether on cell viability, [Ca²⁺]_i levels and membrane fluidity in mouse thymocytes. Toxicol. Letts., 151: 417-428, 2004.
253. Tan, Y., Chen, C-H., Lawrence, D. and Carpenter, D.O. Ortho-substituted PCBs kill cells by altering membrane structure. Toxicol. Sci., 80: 54-59, 2004.
254. Tan, Y., Song, R., Lawrence, D. and Carpenter, D.O. Ortho-substituted but not coplanar PCBs rapidly kill cerebellular granule cells. Toxicol. Sci., 79: 147-156, 2004.
255. Ozcan, M., Yilmaz, B., King, W.M. and Carpenter, D.O. Hippocampal long-term potentiation (LTP) is reduced by a coplanar PCB congener. NeuroToxicology, 25: 981-988, 2004.
256. Ssempebwa, J.C., Carpenter, D.O., Yilmaz, B., DeCaprio, A.P., O=Hehir, D.J. and Arcaro, K.F. Waste crankcase oil: an environmental contaminant with potential to modulate estrogenic responses. J. Toxicol. Environ. Hlth, Part A, 67: 1081-1094, 2004.
257. Foran, J.A., Hites, R.A., Carpenter, D.O., Hamilton, M.C., Mathews-Amos, A. and Schwager, S.J. A survey of metals in tissues of farmed Atlantic and wild Pacific salmon. Environ. Toxicol. Chem., 23: 2108-2110, 2004.
258. Oenga, G.N., Spink, D.C. and Carpenter, D.O. TCDD and PCBs inhibit breast cancer cell proliferation in vitro. Toxicol. In Vitro, 18: 811-819, 2004.
259. Hussain, R.J. and Carpenter, D.O. A comparison of the roles of protein kinase C in long-term potentiation in rat hippocampal areas CA1 and CA3. Cell. Molec. Neurobiol., 25: 649-661, 2005.
260. Hites, R.A., Foran, J.A., Schwager, S.J., Knuth, B.A., Hamilton, M.C. and Carpenter, D.O. Global assessment of polybrominated diphenyl ethers in farmed and wild salmon. Organohalogen Compounds, 66: 3826-3829, 2004.
261. Kudyakov, R., Baibergenova, A., Zdeb, M. and Carpenter, D.O. Respiratory disease in relation to patient residence near to hazardous waste sites. Environ. Toxicol. Pharmacol., 18: 249-257, 2004.
262. Gilbertson, M. and Carpenter, D.O. An ecosystem approach to the health effects of mercury in the Great Lakes basin ecosystem. Environ. Res. 95: 240-246, 2004.
263. Hites, R.A., Foran, J.A., Schwager, S.J., Knuth, B.A., Hamilton, M.C. and Carpenter, D.O. Global assessment of polybrominated diphenyl ethers in farmed and wild salmon. Environ. Sci. Technol., 38: 4945-4949, 2004.
264. DeCaprio, A.P., Johnson, G.W., Tarbell, A.M., Carpenter, D.O. Chiarenzelli, J.R., Morse, G.S., Santiago-Rivera, A.L., Schymura, M.J., and the Akwesasne Task Force on the Environment. PCB exposure assessment by multivariate statistical analysis of serum congener profiles in an adult Native American population. Environ. Res., 98: 284-302, 2005.

**DAVID CARPENTER
EXHIBIT A**

265. Boldyrev, A.A., Kazey, V.I., Leinsoo, T.A., Mashkina, A.P., Tyulina O.V., Tuneva, J.O., Chittur, S. and Carpenter, D.O. Rodent lymphocytes express functionally active glutamate receptors. Biochem. Biophys. Res. Comm., 324: 133-139, 2004.
266. Boldyrev, A.A., Koudinov, A., Berezov, T. and Carpenter, D.O. Amyloid- β induced cell death is independent of free radicals. J. Alzheimer's Dis., 6: 633-638, 2004.
267. Neagu, B., Strominger, N.L. and Carpenter, D.O. Use of bipolar parallel electrodes for well-controlled microstimulation in a mouse hippocampal brain slice. J. Neurosci. Meth., 144: 153-163, 2005.
268. Suk, W.A., Avakian, M.D., Carpenter, D., Groopman, J.D., Scammell, M. and Wild, C.P. Human exposure monitoring and evaluation in the Arctic: The importance of understanding exposures to the development of public health policy. Environ. Health Perspect. 112: 113-120, 2004.
269. Neagu, B., Neagu, E.R., Strominger, N.L. and Carpenter, D.O. A new fast electro-physiological response measured extracellularly in a mouse hippocampal brain slice. Neurosci. Letts., 381: 179-184, 2005.
270. Sergeev, A.V. and Carpenter, D.O. Hospitalization rates for coronary heart disease in relation to residence near areas contaminated with POPs and other pollutants. Environ. Health Perspect., 113: 756-761, 2005.
271. Foran, J.A., Carpenter, D.O., Hamilton, M.C., Knuth, B.A. and Schwager, S.J. Risk-based consumption advice for farmed Atlantic and wild Pacific salmon contaminated with dioxins and dioxin-like compounds. Environ. Health Perspect. 113: 552-556, 2005.
272. Shaw, S.D., Bourakovsky, A., Brenner, D., Carpenter, D.O., Tao, L., Kannan, K. and Hong, C-S. Polybrominated diphenyl ethers (PBDEs) in farmed salmon from Maine and Eastern Canada. In: Proceedings of 25th International Symposium on Halogenated Environmental Organic Pollutants and POPs (DIOXIN 2005), August 21-26, 2005, Toronto, Canada.
273. Carpenter, D.O., DeCaprio, A.P., O=Hehir, D., Akhtar, F., Johnson, G., Scrudato, R.J., Apatiki, L., Kava, J., Golodergren, J., Miller, P.K. and Eckstein, L. Polychlorinated biphenyls in serum of the Siberian Yupik people from St. Lawrence Island, Alaska. Int. J. Circumpolar Health, 64(4): 322-335, 2005.
274. Foran, J.A., Good, D.H., Carpenter, D.O., Hamilton, M.C., Knuth, B.A. and Schwager, S.J. Quantitative analysis of the benefits and risks of consuming farmed and wild salmon. J. Nutr 135: 2639-2643, 2005.
275. Huang, X., Hites, R.A., Foran, J.A., Hamilton, C., Knuth, B.A., Schwager, S.J. and Carpenter, D.O. Consumption advisories for salmon based on risk of cancer and non-cancer health effects. Environ. Res., 101: 263-274, 2006.
276. Shcherbatykh, I., Huang, X., Lessner, L. and Carpenter, D.O. Hazardous waste sites and stroke in New York State. Environ. Health, 4:18, 2005.
277. Hamilton, M.C., Hites, R.A., Schwager, S.J., Foran, J.A., Knuth, B.A. and Carpenter, D.O. Lipid composition and contaminants in farmed and wild salmon. Environ. Sci. Tech., 39: 8622-8629, 2005.
278. Yilmaz, B., Sandal, S., Chen, C-H. and Carpenter, D.O. Effects of PCB 52 and PCB 77 on cell viability, $[Ca^{2+}]_i$ levels and membrane fluidity in mouse thymocytes. Toxicology, 217: 184-193, 2006.
279. Tan, Y., Hori, N., and Carpenter, D.O. Electrophysiological effects of three groups of glutamate metabotropic receptors in rat piriform cortex. Cell. Molec. Neurobiol., 26: 915-924, 2006.
280. Boldyrev, A.A., Carpenter, D.O. and Johnson, P.A., Emerging evidence for a similar role of glutamate receptors in the nervous and immune systems. J. Neurochem., 95: 913-918, 2005.

**DAVID CARPENTER
EXHIBIT A**

281. Sandal, S., Yilmaz, B., Godekmerdan, A., Kelestimur, H. and Carpenter, D.O. Effects of PCBs 52 and 77 on Th1/Th2 balance in mouse thymocyte cell cultures. Immunopharmacol. Immunotoxicol. 27: 601-613, 2005.
282. Carpenter, D.O. Environmental contaminants and learning and memory. International Congress Series, 1287: 185-189, 2006.
283. Carpenter, D.O. Polychlorinated biphenyls (PCBs): Routes of exposure and effects on human health. Rev. Environ. Health, 21: 1-23, 2006.
284. Huang, X., Lessner, L. and Carpenter, D.O. Exposure to persistent organic pollutants and hypertensive disease. Environ. Res., 102: 101-106, 2006.
285. Carpenter, D.O., El-Qaderi, S., Fayzieva, D., Gilani, A., Hambartsumyan, A., Herz, K., Isobaev, M., Kasymov, O., Kudiyakov, R., Majitova, Z., Mamadov, E., Nemer, L., Revich, B., Stege, P., Suk, W., Upshur, R., Yilmaz, B. and Zaineh K. Children's environmental health in Central Asia and the Middle East. Int. J. Occup. Environ. Health, 12: 362-368, 2006.
286. King, W.M., Sarup, V., Sauve, Y., Moreland, C.M., Carpenter, D.O. and Sharma, S.C. Expansion of visual receptive fields in experimental glaucoma. Visual Neurosci. 23: 137-142, 2006.
287. Tuneva, J., Chittur, S., Boldyrev, A.A., Birman, I. and Carpenter, D.O. Cerebellar granule cell death induced by aluminum. Neurotox. Res., 9: 297-304, 2006.
288. Trasande, L., Boscarino, J., Graber, N., Falk, R., Schechter, C., Dunkel, G., Geslani, J., Moline, J., Kaplan-Liss, E., Miller, R.K., Korfmacher, K., Carpenter, D., Balk, S.J., Laraque, D., Frumkin, H. and Landrigan, P.J. The environment in pediatric practice: A study of New York pediatricians' attitudes, beliefs, and practices towards children's environmental health. J. Urban Health, 2006, DOI: 10.1007/s11524-006-9071-4.
289. Surdu, S., Montoya, L.D., Tarbell, A. and Carpenter, D.O. Childhood asthma and indoor allergens in Native Americans in New York. Environ. Health: A Global Access Science Source, 5:22, 2006. DOI: 10.1186/1476-069X-5-22.
290. Ozcan M., Yilmaz, B. and Carpenter, D.O. Effects of melatonin on synaptic transmission and long term potentiation in two areas of mouse hippocampus. Brain Res., 1111: 90-94, 2006.
291. Shaw, S.D., Brenner, D., Berger, M.L., Pulser, E.L., Carpenter, D.O., Hong, C-W and Kannan K. PCBs, dioxin-like PCBs, dioxins, and organochlorine pesticides in farmed salmon (*Salmo salar*) from Maine and Eastern Canada. Environ. Sci. Technol. 40: 5347-5354, 2006.
292. Yilmaz, B., Ssempebwa J., Mackerer, C.R., Arcaro, K.F. and Carpenter, D.O. Effects of polycyclic aromatic hydrocarbon-containing oil mixtures on generation of reactive oxygen species and cell viability in MCF-7 breast cancer cells. J. Toxicol. Environ. Health, Part A: 70: 1-8, 2007.
293. Kouznetsova, M., Huang, X., Ma, J., Lessner, L. and Carpenter, D.O. Increased rate of hospitalization for diabetes and residential proximity of hazardous waste sites. Environ. Health Perspect., 115:75-79, 2007.
294. Yilmaz, Y., Seyran, A.D., Sandal, S., Aydin, M., Colakoglu, N., Kocer, M. and Carpenter, D.O. Modulatory effects of Aroclors 1221 and 1254 on bone turnover and vertebral histology in intact and ovariectomized rats. Toxicology Letts., 166: 276-294, 2006.
295. Shcherbatykh, I. and Carpenter, D.O. The role of metals in the etiology of Alzheimer's disease. J. Alzheimer's Dis., 11: 191-205, 2007.
296. Surdu S, Neamtiu I, Gurzau E, Kasler I and Carpenter D. Blood lead levels and hand lead contamination in children ages 4-6 in Copsa Mica, Romania. In: *Environmental Health in Central and Eastern Europe*. KC Donnelly and LH Cizmas, Eds. Springer Netherlands. pp. 123-134, 2007.

**DAVID CARPENTER
EXHIBIT A**

297. Carpenter D.O. The importance of the Great Lakes Water Quality Agreement. J Public Health Policy 28: 216-220, 2007.
298. Codru N, Schymura MJ, Negoita S, the Akwesasne Task Force on the Environment, Rej R and Carpenter DO. Diabetes in relation to serum levels of polychlorinated biphenyls (PCBs) and chlorinated pesticides in adult Native Americans. Environ Health Perspect. 115: 1442-1447, 2007.
299. Carpenter DO. Biomarcadores de efectos neuroconductuales. Acta Toxicol Argent 14 (Suplemento): 11-12, 2006.
300. Hennig B, Ormsbee L, Bachas L, Silverstone A, Milner J, Carpenter D, Thompson C and Suk WA . Introductory comments: nutrition, environmental toxins and implications in prevention and intervention of human diseases. J Nutrit Biochem 189: 161-163, 2007.
301. Arnold R, Armour MA, Barich J, Cebrian M, Cifuentes L, Kirk D, Koh D, Lewis ND, Ling B, Makalinao I, Maiden T, Paz-y-Mino C, Peralta G, Singh K, Sly P, Suk W, Woodward A, Zheng B and Carpenter DO. Threats to human health and environmental sustainability in the Pacific Basin: The 11th International Conference of the Pacific Basin Consortium. Environ Health Perspect. 115: 1770-1775, 2007.
302. Parrish RR, Horstwood M, Arnason JG, Chenery S, Brewer T, Lloyd NS and Carpenter DO (2008) Depleted uranium contamination by inhalation exposure and its detection after approximately 25 years: Implications for health assessment. Sci Total Environ 390: 58-68.
303. Goncharov A, Haase RF, Santiago-Rivera A, Morse G, Akwesasne Task Force on the Environment, McCaffrey RJ, Rej R and Carpenter DO. (2008) High serum PCBs are associated with elevation of serum lipids and cardiovascular disease in a Native American population. Environ Res. 106: 226-239.
304. Ma J, Kouznetsova M, Lessner L and Carpenter DO. Asthma and infectious respiratory disease in children – correlation to residence near hazardous waste sites. Paediatr Respir Rev 8: 292-298, 2007.
305. Schell LM, Gallo MV, Denham M, Ravenscroft J, DeCaprio AP and Carpenter DO (2008) Relationship of thyroid hormone levels of polychlorinated biphenyls, lead, p,p'-DDE and other toxicants in Akwesasne Mohawk youth. Environ Health Perspect. 116: 806-813.
306. Ssempebwa J and Carpenter DO (2009) The generation, use and disposal of waste crankcase oil in developing countries: A case for Kampala District, Uganda. J Hazard Materials 161: 835-841.
307. Carpenter DO (2008) Environmental contaminants as risk factors for developing diabetes. Rev Environ Health 23: 59-74.
308. Shaw SD, Berger ML, Brenner D, Carpenter DO, Lao L, Hong CS and Kannan K (2008) Polybrominated diphenyl ethers (PBDEs) in farmed and wild salmon marketed in the Northeastern United States. Chemosphere 71: 1422-1431.
309. Sandel S, Yilmaz B and Carpenter DO (2008) Genotoxic effects of PCB 52 and PCB 77 on cultured human peripheral lymphocytes. Mutation Res. 654: 88-92.
310. Carpenter DO and Sage C (2008) Setting prudent public health policy for electromagnetic field exposures. Rev Environ Health 23: 91-117.
311. Neagu B, Strominger NL and Carpenter DO (2008) Contribution of NMDA receptor-mediated component to the EPSP in mouse Schaffer collateral synapses under single pulse stimulation protocol. Brain Res. 1240: 54-61.
312. Holdren J, Tao S and Carpenter DO (2008) Environment and health in the 21st Century: Challenges and solutions. Ann NY Acad Sci. 1140:1-21.

**DAVID CARPENTER
EXHIBIT A**

313. Carpenter DO, Ma J and Lessner L (2008) Asthma and infectious respiratory disease in relation to residence near hazardous waste sites. *Ann NY Acad Sci.* 1140: 201-208.
314. Sandal S, Tuneva J, Yilmaz B and Carpenter DO (2009) Effects of cholesterol and docosahexaenoic acid on cell viability and $(Ca^{2+})_i$ levels in acutely isolated mouse thymocytes. *Cell Biochem Funct* 27: 155-161.
315. Steele RE, de Leeuw, E and Carpenter DO (2009) A novel and effective treatment modality for medically unexplained symptoms. *J Pain Management* 1: 402-412
316. Sage C and Carpenter DO (2009) Public health implications of wireless technologies. *Pathophysiology* 16: 233-246.
317. Sly PD, Eskenazi B, Pronczuk J, Sram R, Diaz-Barriga F, Machin DG, Carpenter DO, Surdu S and Meslin EM (2009) Ethical issues in measuring biomarkers in children's environmental health. *Environ Health Perspect.* 117: 1185-1190.
318. Goncharov A, Rej R, Negoita S, Schymura M, Santiago-Rivera A, Morse G, Akwesasne Task Force on the Environment and Carpenter DO (2009) Lower serum testosterone associated with elevated polychlorinated biphenyl concentrations in Native American men. *Environ Health Perspect.* 117:1454-1460.
319. Tuneva JO, Karpova LV, Shittur SV, Carpenter DO, Johnson P and Boldyrev AA (2009) Amyloid- β and aluminum ions enhance neuronal damage mediated by NMDA-activated glutamate receptors. *Biochemistry (Moscow) Supplement Series A: Membrane and Cell Biology* 4: 466-471.
320. Carpenter DO and Nevin R (2009) Environmental causes of violence. *Physiol Behavior* 99: 260-268.
321. Goncharov A, Bloom MS, Pavuk M, Carpenter DO for the Anniston Environmental Health Research Consortium. (2009) Exposure to PCBs and hypertension in the Anniston Community Health Survey. *Organohal Comp* 71: 0-136.
322. Sergeev AV and Carpenter DO (2010) Residential proximity to environmental sources of persistent organic pollutants and first-time hospitalizations for myocardial infarction with comorbid diabetes mellitus: A 12-year population-based study. *Int J Occup Med Environ Health* 23: 5-13.
323. Carpenter DO (2010) Electromagnetic fields and cancer: The cost of doing nothing. *Rev Environ Health* 25: 75-80.
324. Sergeev AV and Carpenter DO (2010) Exposure to persistent organic pollutants increases hospitalization rates for myocardial infarction with comorbid hypertension. *Primary Prevention Insights.* 2: 1-9.
325. Hori N, Kadota MT, Watanabe M, Ito Y, Akaike N and Carpenter DO (2010) Neurotoxic effects of methamphetamine on rat hippocampus pyramidal neurons. *Cell Mol Neurobiol.*30: 849-856.
326. Hardell, S, Tilander H, Welfinger-Smith G and Carpenter DO (2010) Levels of polychlorinated biphenyls (PCBs) and three organochlorine pesticides in fishes from the Aleutian Islands of Alaska. *PLoS ONE*, 5:e12396.
327. Carpenter, DO. (2010) Human health effects of EMFs: The cost of doing nothing. *IOP Conf. Series: Earth and Environmental Science* 10: 012004. doi:10.1088/1755-1315/10/1/10/012004.
328. Goncharov A, Bloom M, Pavuk M, Birman I and Carpenter DO for the Anniston Environmental Health Research Consortium. Blood pressure and hypertension in relation to levels of serum polychlorinated biphenyls in residents of Anniston, Alabama. *J Hypertension.* 28: 2053-2060..
329. Prasad A, Ahs M, Goncharov A and Carpenter DO (2010) Omega-3 and omega-6 fatty acids kill thymocytes and increase membrane fluidity. *The Open Cell Development & Biology Journal* 3: 1-8

**DAVID CARPENTER
EXHIBIT A**

330. Sergeev AV and Carpenter DO (2010) Increased hospitalizations for ischemic stroke with comorbid diabetes and residential proximity to source of organic pollutants: A 12-year population-based study. *Neuroepidemiology* 35:196-201.
331. Prasad A, Bloom M and Carpenter DO (2010) Role of calcium and ROS in cell death induced by polyunsaturated fatty acids in murine thymocytes. *J Cell Physiol.* 225: 829-836.
332. Sergeev AV and Carpenter DO (2010) Geospatial patterns of hospitalization rates for stroke with comorbid hypertension in relation to environmental sources of persistent organic pollutants: Results from a 12-year population-based study. *Environ Sci Pollut Res Int* 18: 576-585.
333. Brown D, Goncharov A, Paul E, Simonin H and Carpenter DO. (2010) The relationships between Adirondack lake pH and levels of mercury in yellow perch. *J Aquat Animal Health.* 22:280-290.
334. Gavidia T, Brune M-N, McCarty KM, Pronczuk J, Etzel R, Neira M, Carpenter DO, Suk WA, Arnold RG, Ha EH, and Sly PD (2010) Children's environmental health – from knowledge to action. *Lancet* 377:1134-1136.
335. Bushkin-Bedient S and Carpenter DO (2010) Benefits versus risks associated with consumption of fish and other seafood. *Rev Environ Health* 25: 161-191.
336. Goncharov A, Pavuk M, Foushee HR and Carpenter DO for the Anniston Environmental Health Consortium (2010) Blood pressure in relation to concentrations of PCB congeners and chlorinated pesticides. *Environ Health Perspect.* 119:319-325.
337. Yilmaz B, Sandal S and Carpenter DO (2010) PCB 9 exposure induces endothelial cell death while increasing intracellular calcium and ROS levels. *Environ Toxicol.* In press. doi: 10.1002/tox.20676.
338. Sly PD, Arnold RG and Carpenter DO (2011) Environmental exposures in the era of climate change. *Rev Environ Health* 26: 1-4.
339. Carpenter DO (2011) Health effects of persistent organic pollutants: The challenge for the Pacific Basin and for the World. *Rev Environ Health* 26: 61-69.
340. Sergeev AV and Carpenter DO (2011) Increase in metabolic syndrome-related hospitalizations in relation to environmental sources of persistent organic pollutants. *Int J Environ Res Public Health* 8:762-776.
341. Carpenter DO, Miller PK, Waghiyi, Welfinger-Smith G (2011) Environmental contamination of the Yupik people of St. Lawrence Island, Alaska. *J Indigenous Res* In Press.
342. Carpenter DO (2010) Human health effects of EMFs: The cost of doing nothing. *IOP C Ser Earth Env* 10:1-6.
343. Kamalov J, Carpenter DO, Birman I (2011) Cytotoxicity of environmentally relevant concentrations of aluminum in murine thymocytes and lymphocytes. *J Toxicol.* Doi:10.1155/2011/796719.
344. Silbernagel S, Carpenter DO, Gilbert SG, Gochfeld M, Groth E, Hightower JM, Schiavone FM. (2011) Recognizing and preventing over exposure to methylmercury from fish and seafood consumption: Information for physicians. *J Toxicol*, 2011; doi:10.1155/2011/983072
345. Welfinger-Smith G, Minholz JL, Byrne S, Waghiyi V, Gologergen J, Kava J, Apatiki M, Ungott E, Miller PK, Arnason J and Carpenter DO. (2011) Organochlorine and metal contaminants in traditional foods from St. Lawrence Island, Alaska. *J Toxicol Environ Health A.* 74: 1-20.
346. Ahs M, Prasad A, Aminov Z and Carpenter DO (2011) Mechanisms of cell death of thymocytes induced by polyunsaturated, monounsaturated and trans-fatty acids. *J Cell. Biochem.* 112: 3863-3871.

**DAVID CARPENTER
EXHIBIT A**

347. Boberg E, Lessner L and Carpenter DO. (2011) The role of residence near hazardous waste sites containing benzene in the development of hematologic cancers in upstate New York. *Int J Occup Med Environ Health*. 24: 1-12..
348. Turyk ME, Bhazzar SP, Bowerman W, Boysen E, Clark M, Diamond M, Mergler D, Pantazopoulos P, Schantz S and Carpenter DO (2012) Risks and benefits of consumption of Great Lakes fish. *Environ Health Perspect*. 120: 11-18.
349. Ma J, Lessner L, Schreiber J and Carpenter DO (2009) Association between residential proximity to PERC dry cleaning establishments and kidney cancer in New York city. *J Environ Public Health* doi:10.1155/2009/183920.
350. Morse GS, Duncan G, Noonan C, Carrouette E, Santiago-Rivera A, Carpenter DO and Tarbell A (2011) *J Indigen Res* 1: (1) Article 6. <http://digitalcommons.usu.edu/kicjir/vol1/iss1/6>.
351. Liu X, Lessner L and Carpenter DO (2012) Association between residential proximity to fuel-fired power plants and hospitalization rate for respiratory diseases. *Environ Health Perspect* 120: 807-810.
352. Ruzzin J, Lee D-H, Carpenter DO and Jacobs DR Jr. (2012) Reconsidering metabolic disease: The impact of persistent organic pollutants. *Atherosclerosis* 224: 1-3.
353. Florea A-M, Busselberg D and Carpenter D (2012) Metals and disease. *J Toxicol* 2012. Doi:10.1155/2012/825354.
354. Smolyaninova LV, Carpenter DO, Dergalev AA, Kulebyakin KY and Boldyrev AA (2012) Carnosine prevents necrotic and apoptotic death of rat thymocytes via ouabain sensitive Na/K-ATPase. *Cell Biochem Funct*. DOI: 10.1002/cbf.2856.
355. Khwaja HA, Fatmi Z, Malashock D, Aminov Z, Siddique A and Carpenter DO (2012) Effect of air pollution on daily morbidity in Karachi, Pakistan. *J Local Global Health Science*, In press.
356. Scrudato RJ, Chiarenzelli FR, Miller PK, Alexander CR, Arnason J, Zamzow K, Zweifel K, Gologergen J, Kava J, Waghiyi V and Carpenter DO. (2012) Contaminants at Arctic formerly used defense sites. *J Local Global Health Science*. In press.
357. Hoover E, Cook K, Plain R, Sanchez K, Waghiyi V, Miller P, Dufault R, Sislin C and Carpenter DO (2012) Indigenous peoples of North America: Environmental exposures and reproductive justice. *Environ Health Perspect*. 120: 1645-1649.
358. Pantazopoulos P, Sawyer JM, Turyk ME, Diamond M, Bhavsar SP, Mergler D, Schantz S, Ratnayake N and Carpenter DO (2012) Fatty acids in Great Lakes lake trout and whitefish. *J Great Lakes Res*. In press.

Books:

1. Cellular Pacemakers I: Mechanisms of Pacemaker Generation, David O. Carpenter, editor; John Wiley & Sons, New York, 1982.
2. Cellular Pacemakers II: Function in Normal and Disease States, David O. Carpenter, editor; John Wiley & Sons, New York 1982.
3. Biologic Effects of Electric and Magnetic Fields, Volume I: Sources and Mechanisms of Biologic Effects, David O. Carpenter and Sinerik Ayrapetyan, editors; Academic Press, California, 1994.
4. Biologic Effects of Electric and Magnetic Fields, Volume II: Beneficial and Harmful Effects, David O. Carpenter and Sinerik Ayrapetyan, editors; Academic Press, California, 1994.
5. Environmental Challenges in the Pacific Basin, David O. Carpenter, ed. New York Academy of Sciences, Vol 1140, 457 pp, 2008.

DAVID CARPENTER EXHIBIT A

6. Effects of Persistent and Bioactive Organic Pollutants on Human Health. David O. Carpenter, ed. Wiley-Blackwell, In press, 2013.

Reviews and Book Chapters:

1. Carpenter, D.O. Ionic mechanisms and models of endogenous discharge of *Aplysia* neurons. Proceedings of the Symposium on Neurobiology of Invertebrates: Mechanisms of Rhythm Regulation. Tihany, Hungary, August 2-5, 1971, Hungarian Academy of Sciences, pp. 35-58, 1973.
2. Carpenter, D.O., Hovey, M.M. and Bak, A.F. Measurements of intracellular conductivity in *Aplysia* neurons: Evidence for organization of water and ions. Ann. NY Acad. Sci., 204:502-533, 1973.
3. Carpenter, D.O., Hubbard, J.H., Humphrey, D.R., Thompson, H.K. and Marshall, W.H. CO₂ effects on nerve cell function. In: Topics in Environmental Physiology and Medicine: Carbon Dioxide and Metabolic Regulation. (Eds.: G. Nahas and K.A. Schaefer), Springer-Verlag, New York, pp. 49-62, 1974.
4. Parmentier, J. and Carpenter, D.O. Blocking action of snake venom neurotoxins at receptor sites to putative central nervous system transmitters. In: Animal, Plant and Microbial Toxins (Eds.: A. Ohaska, K. Hayashi, and Y. Sawai), Plenum Press, London, Vol. 2, pp. 179-191, 1976.
5. Pierau, Fr.-K. and Carpenter, D.O. Metabolic control of peripheral temperature receptors in the scrotal skin of the rat. Israel J. Med. Sci., 12:1044-1046, 1976.
6. Carpenter, D.O. Membrane Excitability: In: Mammalian Cell Membranes Vol. 4, Membranes and Cellular Functions, (Eds.: G.A. Jamieson and D.M. Robinson), Butterworth & Co., London, pp. 184-206, 1977.
7. Carpenter, D.O., Myers, P.R., Shain, W., Sinback, C.N. and Swann, J.W. Interchangeable association of neurotransmitter receptors and ionophores in vertebrate and invertebrate cells. Proc. Symposium: "Ionophoresis and Transmitter Mechanisms in the Mammalian Central Nervous System", Cambridge, England, Raven Press, pp. 203-205, 1978.
8. Carpenter, D.O., McCreery, M.J., Woodbury, C.M. and Yarowsky, P.J. Modulation of endogenous discharge in neuron R-15 through specific receptors for several neurotransmitters. In: Abnormal Neuronal Discharges, (Eds: N. Chalazonitis and M. Boisson), Raven Press, New York, pp. 189-203, 1978.
9. Tsien, R.W. and Carpenter, D.O. Ionic mechanisms of pacemaker activity in cardiac purkinje fibers. Fed. Proc., 37:2127-2131, 1978.
10. Keabian, P.R., Keabian, J.W. and Carpenter, D.O. Serotonin causes accumulation of cyclic AMP in *Aplysia* heart. The Proceedings of the Fourth International Catecholamine Symposium, (Eds: E. Usdin and I. Kopin), Pergamon Press, New York, pp. 1167-1169.
11. Braitman, D.J., Auker, C.R. and Carpenter, D.O. Direct and modulatory actions of thyrotropin-releasing hormone (TRH) in sensorimotor cortex. Proc. EMBO Workshop on Drug Receptors in the Central Nervous System, Weizman Institute of Science, Rehovot, Israel, February 10-14, 1980.
12. Carpenter, D.O. Ionic and metabolic bases of neuronal thermosensitivity. Fed. Proc., 40:2808-2813, 1981.
13. Carpenter, D.O. and Reese, T.S. Chemistry and Physiology of Synaptic Transmissions. In: Basic Neurochemistry, 3rd Edition, (Eds.: Siegel, Albers, Agranoff and Katzman), Little, Brown and Company, pp. 161-168, 1981.
14. Shain, W. and Carpenter, D.O. Mechanisms of synaptic modulation. Intl. Rev. Neurobiol., 22:205-247, 1981.

**DAVID CARPENTER
EXHIBIT A**

15. Wiederhold, M.L. and Carpenter, D.O. Possible Role of Pacemaker Mechanisms in Sensory Systems. In: Cellular Pacemakers II: Function in Normal and Disease States, (Ed.: D.O. Carpenter), John Wiley & Sons, New York, pp. 27-58, 1982.
16. Carpenter, D.O. The generator potential mechanism in cold afferents may be an electrogenic sodium pump. Workshop on Mechanisms of Thermal Regulations. J. Therm. Biol., 387-390, 1983.
17. Carpenter, D.O. and Gregg, R.A. Functional significance of electrogenic pumps in neurons. In: Electrogenic transport: Fundamental Principles and Physiological Implications, (Eds.: M. Blaustein and M. Liebermann), Raven Press, pp. 253-270, 1984.
18. Carpenter, D.O., Briggs, D.B. and Strominger, N. Behavioral and electrophysiological studies of peptide-induced emesis in dogs. Fed. Proc., 43:16-18, 1984.
19. Coyle, J.T., Blakeley, R.D., Zaczeck, R., Ory-Lavallee, L., Koller, K., French-Mullen, J.M.H. and Carpenter, D.O. Acidic peptides in brain: Do they act at putative glutamatergic synapses. In: Excitatory Amino Acids and Epilepsy, (Eds.: Y. Ben-Ari and R. Schwarcz), Plenum Press, New York, pp. 375-384.
20. Carpenter, D.O., French-Mullen, J.M.H., Hori, N., Sinback, C.N. and Shain, W. Segregation of synaptic function on excitable cells. In: Neural Mechanisms of Conditioning, (Eds.: D. Alkon and C.D. Woody), Plenum Press, NY, pp. 355-369, 1985.
21. Carpenter, D.O. and Hall, A.F. Responses of Aplysia cerebral ganglion neurons to leucine enkephalin. In: Comparative Aspects of Opioid and Related Neuropeptide Mechanisms, (Eds.: M. Leung and G. Stefano), CRC Press, pp. 49-57.
22. Zaczeck, R., Koller, K., Carpenter, D.O., Fisher, R., French-Mullen, J.M.H. and Coyle, J.T. Interactions of acidic peptides: Excitatory amino acid receptors. In: Excitatory Amino Acids, (Ed.: P.J. Roberts), Macmillan, London, 1987.
23. Carpenter, D.O. Central nervous system mechanisms in deglutition and emesis. In: Handbook of Physiology, Section 6: The Gastrointestinal System. Vol. I, Motility and Circulation, (Ed.: J.D. Wood), American Physiological Society, Chapter 18, pp. 685-714, 1989.
24. Carpenter, D.O., Briggs, D.B. and Strominger, N. Mechanisms of radiation-induced emesis in the dog. Pharmacol. Ther., 39:367-371, 1988.
25. Carpenter, D.O. Comparative biology of neurotransmitter functions. Biology International, 15:2-9, 1987.
26. Carpenter, D.O. Electromagnetic Fields: Do We Know Enough to Act? In: Health and Environmental Digest, Vol. 2, pp. 3-4, 1988.
27. Carpenter, D.O. The New York State Power Lines Project: Summary and Conclusions. In: 20th Annual National Conference on Radiation Control, CRCPD Publication 88-6, Nashville, Tennessee, May 15-19, 1988, pp. 399-409.
28. S.-Rozsa, K., Carpenter, D.O., Stefano, G.B. and Salanki, J. Distinct responses to opiate peptides and FMRFamide on B-neurons of the Aplysia cerebral ganglia. In: Comparative Aspects of Neuropeptide Function, (Eds. E. Florey and G.B. Stefano), Manchester University Press, Chapter 6, pp. 73-86, 1991.
29. Carpenter, D.O. A common mechanism of excitation of area postrema neurons by several neuropeptides, hormones and monoamines. In: Comparative Aspects of Neuropeptide Function, (Eds. E. Florey and G.B. Stefano) Manchester University Press, Chapter 21, pp. 260-270, 1991.
30. Carpenter, D. O., Hirotsu, I., Katsuda, N. and Hori, N. The effects of acetylcholine and aging on electrical excitability of the central nervous system. In: Neuroregulatory Mechanisms in Aging, Pergamon Press LTD, pp. 5-23, 1993.

**DAVID CARPENTER
EXHIBIT A**

31. Turner, J.N., Swann, J.W., Szarowski, D.H., Smith, K.L., Shain, W., Carpenter, D.O. and Fejtli, M. Three-dimensional confocal light and electron microscopy of neurons: fluorescent and reflection stains. Methods in Cell Biology, 38:345-366, 1993.
32. Deno, D. and Carpenter, D.O. Sources and characteristics of electric and magnetic fields in the environment. In: Biologic Effects of Electric and Magnetic Fields, Volume I: Sources and Mechanisms of Biologic Effects, David O. Carpenter and Sinerik Ayrapetyan, editors, Academic Press, California, pp. 3-59, 1994.
33. Carpenter, D.O. The public health implications of magnetic field effects on biological systems. In: Biologic Effects of Electric and Magnetic Fields, Volume II: Beneficial and Harmful Effects, David O. Carpenter and Sinerik Ayrapetyan, editors, Academic Press, California, pp. 321-329, 1994.
34. Carpenter, D.O. Multidisciplinary study of hazardous wastes at a Great Lakes Superfund Site. Great Lakes Research Review, 1: 37-39, 1994.
35. Fejtli, M. and Carpenter, D.O. Single-channel studies in molluscan neurons. In: Ion Channels, Vol. 4, Toshio Narahashi, ed., Plenum Press, New York, pp. 333-376, 1996.
36. Turner, J.N., Swann, J.W., Szarowski, D.H., Smith, K.L., Shain, W., Carpenter, D.O. and Fejtli, M. Three-dimensional confocal light and electron microscopy of central nervous system tissue, and neurons and glia in culture. In: International Review of Experimental Pathology, V.J. Savin and T.B. Wiegmann, editors, Volume 36, Academic Press, pp. 53-72, 1996.
37. Boldyrev, A., Lawrence, D. and Carpenter, D. Effect of carnosine and its natural derivatives on apoptosis of neurons induced by excitotoxic compounds. In: Peptide Science-Present and Future, Y. Shimonishi, editor, Kluwer Academic Publishers, Great Britain, pp. 424-426, 1998.
38. Carpenter, D.O., Hussain, R., Tan, Y., Niemi, W. and Hori, N. Long-term potentiation and long-term depression: Relevance to learning and memory. In: Modern Problems of Cellular and Molecular Biophysics, S.N. Ayrapetyan and A.C.T. North, editors, Nayan Tapan, pp. 83-94, 2001.
39. Carpenter, D.O. NMDA receptors and molecular mechanisms of excitotoxicity. In: Oxidative Stress at Molecular, Cellular and Organ Levels, A. Boldyrev and P. Johnson, editors, Research Signpost, pp. 77-88, 2002.
40. Carpenter, D.O. Clearing the air: Asthma an indoor exposure. JNMA 96: 1-2, 2004.
41. Carpenter DO. Environmental contaminants and human health: The health effects of persistent toxic substances. Firat Tip Dergisi 10: ____: 2005.
42. Hermanson MH, Johnson GW and Carpenter DO. Routes of human exposure to PCBs in Anniston, Alabama. ACS Division of Environmental Chemistry, 232rd National Meeting, 46: 1117-1122, 2006
43. Carpenter DO and Welfinger-Smith G. The Hudson River: A case study of PCB contamination. In: Water and Sanitation-Related diseases and the Environment: Challenges, Interventions, and Preventative Measures. Janine M.H. Selendy, Ed., Wiley & Sons, Inc. 2011, pp 303-327.
44. Welfinger-Smith G and Carpenter DO. Addressing sources of PCBs and other chemical pollutants in water. In: Water and Sanitation-Related diseases and the Environment: Challenges, Interventions, and Preventative Measures. Janine M.H. Selendy, Ed., Wiley & Sons, Inc. 2011, pp 359-384.

Other Publications:

1. Barker, J.L. and Carpenter, D.O. Neuronal thermosensitivity. Science, 172:1361-1362, 1971.

**DAVID CARPENTER
EXHIBIT A**

2. Carpenter, D.O. Cellular Pacemakers. Fed. Proc., 37:2125-2126, 1978.
3. Carpenter, D.O. Membrane biophysics and general neurobiology in Japan. ONR Tokyo Scientific Bulletin, 3:23-27, 1978.
4. Carpenter, D.O. Research on the primate nervous system in Japan. ONR Tokyo Scientific Bulletin, 3:28-32, 1978.
5. Carpenter, D.O. Report on the Sixth International Biophysics Congress, Kyoto, Japan. ONR Tokyo Scientific Bulletin, 3:38-40, 1978.
6. Carpenter, D.O. Interchangeable association of neurotransmitter receptors with several ionophores. Brain Research Bulletin, 4:149-152, 1978.
7. Carpenter, D.O. and Ahlbom, A. Power lines and cancer: Public health and policy implications. Forum, 3:96-101, 1988.
8. Carpenter, D.O. Setting Health Policy When the Science and the Risk are Uncertain. In: The Scientific Basis of Health Policy in the 1990s, Proceedings of the School of Public Health's Fifth Anniversary Symposium, 54-63, 1990.
9. Carpenter, D.O. Integrating public health in professional education. Optometry and Vision Science, 70: 699-702, 1993.
10. Bowerman, W.W., Carey, J., Carpenter, D.O., Colborn, T., DeRosa, C., Fournier, M., Fox, G.A., Gibson, B.L., Gilbertson, M., Henshel, D., McMaster, S. and Upshur, R. Is it time for a Great Lakes Ecosystem Agreement separate from the Great Lakes Water Quality Agreement? J. Great Lakes Res. 25:237-238, 1999.
11. Carpenter, D.O. Editorial Comment of APrimary hypoxic tolerance and chemical preconditioning during estrus cycle. Stroke, 30:1262, 1999.
12. Carpenter, D.O. Bring environmental health back into public Health. J. Pub. Health Mgmt. Pract., 5:vii-viii, 1999.
13. Carpenter, D.O. Should children and women of childbearing age eat Great Lakes fish? Great Lakes Commission Advisor, 13: 8, 2000.
14. Hites, R.A., Foran, J.A., Schwager, S.J., Knuth, B.A., Hamilton, M.C. and Carpenter, D.O. Response to comment on AGlobal Assessment of Polybrominated Diphenyl Ethers in Farmed and Wild Salmon. Environ. Sci. Technol. 39: 379-380.
15. Carpenter, D.O. Blood lead and IQ in older children. Letter to the editor. Environ. Health Perspect., 113: A581-A582, 2005.
16. Foran, J.A., Carpenter, D.O., Good, D.H., Hamilton, M.C., Hites, R.A., Knuth, B.A. and Schwager, S.J. Risks and benefits of seafood consumption. Letter to the editor. Am. J. Prev. Med. 30: 438-439, 2006.
17. Bolte G, Kohlhuber M, Carpenter DO and Tamburlini G Environmental inequalities among children and adolescents in Europe. Report prepared and submitted to the World Health Organization, 2009.
18. Toxins and the Brain. PSR's Environmental Health Policy Institute, 9 April 2012

***PRE-FILED TESTIMONY
OF DAVID O. CARPENTER, M.D.
MPUC Docket No. 2011-00262***

1 **Q. Please state your name and business address.**

2 A. My name is David O. Carpenter. My business address is:

3 Institute for Health and the Environment
4 University at Albany
5 Five University Place, Room A217
6 Rensselaer, NY 12144-3456

7 **Q. Briefly state your occupation, educational background and current**
8 **employment.**

9 A. I am a public health physician and professor, with a medical degree from Harvard
10 Medical School. I have held various positions in the public health field. My
11 current title is Director of the Institute for Health and the Environment at the
12 University at Albany and Professor of Environmental Health Sciences within the
13 School of Public Health. In addition I am an Honorary Professor, Queensland
14 Children's Medical Research Unit, University of Queensland, Brisbane, Australia.

15 Formerly, I was the Director of the Wadsworth Center for Laboratories and
16 Research of the New York State Department of Health and the Dean of the School
17 of Public Health at the University of Albany, while remaining employed by the
18 New York State Department of Health. I assumed my current position in 1998.

19 I served as the Executive Secretary to the New York State Powerlines
20 Project in the 1980s, a program of research that showed that children living in
21 homes with elevated magnetic fields coming from powerlines suffered from an

1 elevated risk of developing leukemia, and that electromagnetic field (EMF)
2 exposure altered a variety of responses studied in animals and in cellular systems.
3 After this, I became the spokesperson on EMF issues for New York during the
4 time of my employment in the Department of Health.

5 Attached as Exhibit A is my *curriculum vitae*.

6 **Q. Are you a member of any professional organizations?**

7 A. I participate in many international, national, state and local organizations and
8 committees as listed in my *curriculum vitae* along with the Honors, Awards, and
9 Fellowships I have received.

10 **Q. Have you authored any papers or journal articles?**

11 A. I have authored over 350 major publications in peer-reviewed scientific journals,
12 have edited five books and have numerous other publications as listed in my
13 *curriculum vitae*.

14 **Q. Briefly describe your work and experience related to the study of health risks**
15 **related to electromagnetic fields and radio frequency waves in the 30 MHz to**
16 **300 GHz range ("RF"). Identify any studies or published writings on the**
17 **subject.**

18 I have published several reviews and have edited two books on the Biologic
19 Effects of Electric and Magnetic Fields. I am also a Co-Editor and a Contributing
20 Author of the *BioInitiative Report: A Rationale for a Biologically-based Public*
21 *Exposure Standard for Electromagnetic Fields (ELF and RF)*
22 www.bioinitiative.org. This report was first published in 2007, and has just now

1 been updated in 2012. The *BioInitiative Report* documents bioeffects, adverse
2 health effects and public health conclusions about impacts of electromagnetic
3 radiation (electromagnetic fields including extremely-low frequency ELF-EMF
4 and radiofrequency /microwave or RF-EMF fields). I will refer to specific
5 sections of the report where appropriate but I also reference the entire report as a
6 comprehensive and up-to-date review of the scientific information on this subject.

7
8 In 2009, I was invited to present to the President's Cancer Panel on the
9 subject of power line and radiofrequency fields and cancer, and have also testified
10 on this issue before the United States House of Representatives.

11 **Q. Are you familiar with peer-reviewed studies addressing the biological effects**
12 **of exposure to low-level RF, and their potential health effects?**

13 A. There are many peer-reviewed studies reporting biological effects and health risks
14 related to low-level RF exposure. A comprehensive listing of these publications is
15 found in the *Bioinitiative Report*, which includes both positive and negative
16 research studies. In this testimony, I will not list peer-reviewed publications dated
17 prior to 2000 or any covered by publications that are systematic reviews or meta-
18 analyses reported after that time. I will focus on human studies, and only cover
19 briefly the huge number of cellular and animal studies. In my judgment the
20 scientific results of greatest importance, consistency and relevance to human
21 health are listed first.

1 Q. Is there reliable evidence from epidemiological studies to support the conclusion
2 that low-level RF (below the level at which thermal effects are confirmed) can
3 cause adverse health effects?

4 There is consistent evidence for harm from low-level RF radiation in
5 studies of individuals using cell phones for prolonged periods of time, which gives
6 a localized exposure to the ipsilateral brain, auditory nerve and parotid gland in the
7 cheek. There have been seven major publications that are either meta-analyses or
8 pooled analyses that evaluate all of the earlier literature, and most find statistically
9 significant relations between elevated exposure to radiofrequency radiation from
10 cell phones and increased risk of brain cancer. I will also discuss several recent
11 individual studies on cell phone exposure and some relevant studies on radio
12 transmission exposure. I will refer frequently to the odds ratio (OR) or risk ratio
13 (RR). These are statistical analysis terms that are used to determine whether or
14 not results are statistically significant. The standard use is to give an OR or RR
15 followed by the 95% confidence interval. Thus, if there is no difference between
16 the "exposed" and "control" populations, the OR or RR will be 1. If there is an
17 elevated risk the OR or RR will be greater than 1.0, whereas if the exposure
18 reduces risk of disease the OR or RR will be less than 1.0. For exposures that
19 increase risk, results are considered to be statistically significant if the 95% CI has
20 a lower bound that is greater than 1, which is to say that there is less than a 5%
21 possibility that the result occurred by chance. The seven major meta-analysis and
22 pooled analysis publications I mentioned are summarized below:

1
2 a. Hardell L, Carlberg M, Soderqvist F, Mild KH. 2008. Meta-analysis
3 of long-term mobile phone use and the association with brain tumours.
4 *Internat J Oncology* 12: 1097-1103. In ten studies of glioma, cell phone
5 use for more than ten years gave an OR of 1.2 (95%CI=0.8-1.9) (thus this
6 result would not be considered to be significant, since the lower bound is
7 less than 1.0). For ipsilateral cell phone use for more than 10 year the OR =
8 2.0 (1.2-3.4) (thus this result is statistically significant, since the lower
9 bound is greater than 1.0). There was also a significant association for
10 acoustic neuroma and ipsilateral cell phone use for ten years or more, but
11 no relation for meningioma.
12

13 b. Kundi M. 2009. The controversy about a possible relationship
14 between mobile phone use and cancer. *Environ Health Perspect* 117: 316-
15 324. Reviewed data from 33 epidemiological studies and concludes that
16 the combined OR = 1.5 (1.2-1.8) for glioma and 1.1 (0.8-1.4) for
17 meningioma.
18

19 c. Myung SK, Ju W, McDonnell DD, Lee YJ, Ksazinet G, Cheng CT,
20 Moskowitz JM. 2009. Mobile phone use and risk of tumors: A meta-
21 analysis. *J Clin Oncol* 27:5565-5572. Reviewed 465 publications that
22 reported on 12,344 cases of cancer and 25,572 controls. Risk of developing
23 brain cancer was OR = 1.8 (1.04-1.34) for more than ten years use.
24

25 d. Ahlbom A, Feychting M, Green A, Kheifet L, Savitz DA and
26 Swedlow AJ (ICNIRP Standing Committee on Epidemiology). 2009.
27 Epidemiologic evidence on mobile phones and tumor risk: A review.
28 *Epidemiology* 20: 639-652. Comment that most studies of glioma show
29 small increased or decreased risk among users, although a subset of studies
30 show appreciably elevated risks. They then argue that there are
31 methodological reasons for these positive studies.
32

33 e. Khurana VG, Teo C, Kundi M, Hardell L and Carlberg. 2009. Cell
34 phones and brain tumors: a review including the long-term epidemiological
35 data. *Surg Neurol* 72: 205-214. Meta-analysis of 11 studies. They
36 conclude that using a cell phone for more than 10 years approximately
37 doubles the risk of being diagnosed with a brain tumor (glioma, OR = 1.9,
38 1.4-2.4, and acoustic neuroma, OR = 1.6, 1.1-2.4) on the ipsilateral side of
39 the head.
40

41 f. Repacholi MH, Lerchl A, Roosli M, Sienkiewica Z, Auvinen A, et
42 al. 2012. Systematic review of wireless phone use and brain cancer and
43 other head tumors. *Bioelectromagnetics* 33: 187-206. Meta-analysis of

1 studies shows no relationship between brain cancers and ever use of a
2 mobile phone (for glioma, OR = 1.07, 0.89-1.29, based on eight studies and
3 use for one to five years), but there is sparse data on long-term use. Meta-
4 analysis of oncogenicity, tumor promotion and genotoxicity studies also
5 showed no statistically significant relationship between RF exposure and
6 genotoxic damage to brain cells.

7
8 g. Hardell L, Carlberg M, Hansson Mild K. 2012. Use of mobile
9 phones and cordless phones is associated with increased risk for glioma and
10 acoustic neuroma. Pathophysiology doi:10.1016/j.pathophys.2012.11.001.
11 In a review of current evidence they report that a meta-analysis for glioma
12 in the temporal lobe, gave an OR = 1.74 (1.04-2.81). For ipsilateral mobile
13 phone use for 1640 hours or more gave an OR = 2.29 (1.56-3.37). For
14 acoustic neuroma, use for more than 10 years gave an OR = 1.81 (0.73-
15 4.45), and for ipsilateral cumulative use of the same duration the OR = 2.55
16 (1.50-4.40).

17
18 A partial list of recent research studies on cell phone exposure (not reviews) are
19 listed below:

20
21 a. The INTERPHONE Study Group. 2010. Brain tumour risk in
22 relation to mobile telephone use: results of the INTERPHONE international
23 case-control study. Int J Epidemiol 39:675-694. While ever vs. never
24 using a cell phone did not increase risk of brain cancer, there was a
25 significant OR= 2.18 (1.43-3.31) for use for ten or more years, OR=1.82
26 (1.15-2.89) for use for 1640 hours or more and OR=1.31 (0.82-2.11) for
27 more than 270 calls, all for glioma. No significant relations were seen for
28 meningioma. It should be noted that separate INTERPHONE results have
29 been published for Sweden (Lonn et al. 2005. J Epidemiol 161: 526-636)
30 and Germany (Schuz et al. 2006. J Epidemiol 163: 512-520). The German,
31 but not the Swedish study, reported elevated rates of glioma with cell phone
32 use for more than 10 years.

33
34 b. The INTERPHONE Study Group. 2011. Acoustic neuroma risk in
35 relation to mobile telephone use: Results of the INTERPHONE
36 international case-control study. Cancer Epidemiol 35: 453-464. Ever
37 using a cell phone was not associated with elevated risk, nor was use for 10
38 years or more. For more than 1640 hours of use the OR was 2.79 (1.51-
39 5.16).

40
41 c. Larjavaara S, Schüz J, Swerdlow A, Feychting M, Johansen C, et al.
42 2011. Location of gliomas in relation to mobile telephone use: A case-case
43 and case-specular analysis. Am J Epidemiol 174: 2-11. Investigated 888

gliomas from seven European countries (INTERPHONE data) to determine whether the gliomas were located on the side of the head where the cell phone was regularly used. They found an elevated, but not significant, relationship in case-case analysis, but no difference in the case-specular analysis.

d. Levis AG, Minicuci N, Ricci P, Gennaro V, Gabisa S. 2011. Mobile phones and head tumours. The discrepancies in cause-effect relationships in the epidemiological studies – how do they arise? *Environ Health* 10:59 doi: 10.1186/1476-069X-10-59. When studies that were blinded, free from errors and bias were considered, cell phone use for more than ten years resulted in a near doubling in ipsilateral glioma and acoustic neuroma.

e. Aydin D, Feychting M, Schuz J, Tynes T, Andersen TV, et al. 2011. Mobile phone use and brain tumors in children and adolescents: A multicenter case-control study. *J Natl Cancer Inst* 103: 1264-1276. Studied all children between ages 7-19 with a brain tumor in four European countries. OR for regular mobile phone users was 1.36 (0.92-2.02), and for those using phones at least five years was 1.26 (0.70-2.28). Thus, rates were elevated but not statistically significant and there was no evidence of a dose-response relationship. However, for more than 2.8 years subscription the OR = 2.15 (1.07-4.29), and almost all ORs were elevated when comparing users to non-users. There were highly significant ORs with time since first use, cumulative duration of subscriptions, cumulative duration of call and cumulative number of calls, and these were found on both ipsi- and contralateral sides of the head. This is important, since the evidence for elevated risk only ipsilateral comes from data only on adults, and other evidence indicates greater penetration into the brain of a child. None-the-less, the authors conclude that this study provides no support for a relationship between cell phone use and brain cancer in children and adolescents because of the failure to find a dose-response relationship. The conclusions drawn in this study have been questioned by Soderqvist et al. (*Environ Health* 2011. 10:106) on the basis of the fact that individuals using cordless phones, which generate comparable RF exposure to that from cell phones, was included in the “unexposed” category, and that among the four countries studied ORs for Denmark, Sweden and Switzerland were 1.73, 1.49 and 1.69, respectively, while that for Norway was 0.51. They suggest that this may reflect some methodological difference or bias.

f. Cardis E, Armstrong BK, Bowman JD, Giles GG, Hours M, et al. 2011. Risk of brain tumours in relation to estimated RF dose from mobile phones: results from five Interphone countries. *Occup Environ Med* 68:

631-640. ORs for tumours in the most exposed part of the brain in those with 10+ years of mobile phone use were 2.80 (1.13-6.94), and were significantly elevated after 7 years of use. The pattern for meningioma was similar but the ORs were lower.

g. Frei P, Poulsen AH, Johansen C, Olsen JH, et al. 2011. Use of mobile phones and risk of brain tumours: update of Danish cohort study. BMJ doi: 10.1136/bmj.d6387. Used the Danish cancer registry of 3.8 million persons. There were 10,729 cases of brain cancer between 1990-2007. No increased risk of brain tumors were found among cell phone subscribers as compared to non-subscribers. However, cordless phone subscribers were treated as non-cell phone users in this study.

h. Carlberg M, Hardell L. 2012. On the association between glioma, wireless phones, heredity and ionizing radiation. Pathophysiology 19: 243-252. Reports on two case-control studies of 1148 glioma cases. They find an OR = 2.9 (1.8-4.7) for ipsilateral use of mobile phones for more than ten years. For use of cordless phones they find an OR = 3.8 (1.8-8.1) for ipsilateral use for more than 10 years. ORs were higher for high grade gliomas. Risks were highest among those under age 20.

There are several reports investigating rates of cancer, particularly leukemia, in persons living near to AM or FM radio transmission towers or cell towers. While most of these studies report elevations in rates of cancer, their assessment of exposure is limited only to residential proximity to the towers, which is not a very exact monitor. None-the-less, these studies are significant because they directly monitor rates of human cancer. They also suggest that leukemia is the cancer of greatest concern when the whole body is exposed to radiofrequency radiation, in contrast to more localized cancers with localized exposure.

a. Michelozzi P, Capon A, Kirchmayer U, Forastiere F, Biggeri A, Barca A, Perucci CA. 2002. Adult and childhood leukemia near a high-power radio station in Rome, Italy. Am J Epidemiol 155: 1098-1103. The authors show that there is a significant elevation of childhood leukemia among residents living near to Vatican Radio (Standardized mortality ratio

1 = 2.2, 1.0-4.1), and that the risk declines with distance away from the
2 transmitter (p = 0.03).

3
4 b. Eger H, Hagen KU, Lucas B, Vogel P and Voit H. 2004. Einfluss
5 der räumlichen Nähe von Mobilfunksendeanlagen auf die Krebsinzidenz.
6 Umwelt-Medizin-Gesellschaft 17: 326-332. A German government-
7 supported study of cancer risk in relation to residence close to cell towers
8 found that rates were significantly higher (OR = 3.38, 95% CI = 1.39-8.25;
9 99% CI = 1.05-10.91) for persons living within 400 m than among those
10 living further away from the towers.

11
12 c. Park SK, Ha M, Im HJ. 2004. Ecological study on residences in the
13 vicinity of AM radio broadcasting towers and cancer death: preliminary
14 observations in Korea. Int Arch Occup Environ Health. 77:387-394. This
15 study found higher mortality areas for all cancers and leukemia in some age
16 groups in the area near the AM towers.

17 d. Ha M, Im H, Lee M, Kim HJ, Kim BC, Gimm YM, Pack JK. 2007.
18 Radiofrequency radiation exposure from AM radio transmitters and
19 childhood leukemia and brain cancer. Am J Epidemiol 166: 270-279.
20 Leukemia and brain cancer in children in Korea were investigated in
21 relation to residence within 2 km of AM radio transmitters. There was a
22 significant elevation in rates of leukemia (OR = 2.15, 1.00-4.67), but not of
23 brain cancer in relation to peak, but not total radiofrequency exposure for
24 children living within 2 km as compared to more than 20 km from the
25 transmitters.

26
27 e. Merzenich H, Schmiedel S, Bannack S, Bruggemeyer H, Phillipp J,
28 et al. 2008. Childhood leukemia in relation to radio frequency
29 electromagnetic fields in the vicinity of TV and radio broadcast
30 transmitters. Am J Epidemiol 168: 1169-1178. Studied 1,959 cases of
31 leukemia and 5,848 controls in Germany. They did not find any significant
32 relationship between risk of leukemia and living within 2 km of a broadcast
33 transmitter as compared to those living 10-15 km away.

34
35 f. Elliott P, Toledano MB, Bennett J, Beale L, Best N, Briggs DF.
36 2010. Mobile phone base stations and early childhood cancer: case-control
37 study. BMJ 340: c3077 doi:10.1136/bmj/c3077. No association was found
38 between risk of early childhood cancers and estimates of mother's exposure
39 to mobile phone base stations during pregnancy.

40
41 g. Dode AC, Leao M, Tejo FdeAF, Gomes ACR, Dode DC, Dode MC,
42 Moreira CW, Condessa VA, Albinatti C and Calaffa WT. 2011. Mortality

1 by neoplasia and cellular telephone base stations in the Belo Horizonte
2 municipality, Minas Gerais State, Brazil. Sci Total Environ 409: 3649-
3 3665. This study shows higher rates of death from cancer among
4 individuals living close to cell towers than among those living further away.
5 Rates were highest in residences less than 100 m, falling to near
6 background a 1,000 m.

7
8 In summary, the ten major meta-analyses/pooled analyses, the recent cell phone
9 exposure studies, and the radio transmission exposure studies provide convincing
10 evidence of adverse health effects in humans associated with low-level RF
11 exposure. Other relevant evidence of human health effects is discussed in
12 Sections 11 and 12 of the *Bioinitiative Report* 2012.

13 Q. Is there evidence about the mechanisms by which low-level RF may adversely
14 affect human physiology?

15 Some, especially those from the physics and engineering community, are skeptical
16 of the ability of radiofrequency radiation to alter human physiological functions
17 because of the low energy of the non-ionizing portion of the electromagnetic
18 spectrum. The studies listed below provide evidence that cell phone use and
19 applied low-level radiofrequency radiation alter the metabolism of the brain and
20 various clinical measures in humans. They report a variety of effects on humans
21 including dose-dependent changes in cortisol and alpha-amylase, increased brain
22 glucose metabolism, chronic dysregulation of the catecholamine system, and
23 decreases in ACTH, cortisol, thyroid hormones, and prolactin in young females
24 and testosterone in males.

25 a. Augner C, Hacker GW, Oberfeld G, Florian M, Hitzl W, Hutter J,
26 Pauser G. 2010. Effects of exposure to base station signals on salivary

1 cortisol, alpha amylase and immunoglobulin A. Biomed Environ Sci
2 23:199-207. This was a human experimental study with exposure to pulsed
3 wave microwave radiation wherein immune indicators were monitored after
4 five 50-minute sessions. The researchers found dose-dependent changes in
5 cortisol and alpha-amylase.
6

7 b. Volkow ND, Tomasi D, Wange GJ, Vaska P, Fowler JS, Teland F,
8 Alexoff D, Logan J, Wong C. 2011. Effects of cell phone radiofrequency
9 signal exposure on brain glucose metabolism. JAMA 305:808-814. In
10 healthy participants and compared with no exposure, 50-minute cell phone
11 exposure was associated with increased brain glucose metabolism in the
12 region closest to the antenna. This shows direct effects of RF radiation on
13 the brain with cell phone use.
14

15 c. Buchner K, Eger H. 2011. Changes of clinically important
16 neurotransmitters under the influence of modulated RF fields – a long-term
17 study under real-life conditions. Umwelt-Medizin-Gesellschaft 24:44-57.
18 There was clear evidence of health-relevant effects, including an increase in
19 adrenaline and noradrenaline, and a subsequent decrease in dopamine in
20 people living near to a new MW-emitting base station. Levels of
21 phenylethylamine decreased and remained decreased, indicating chronic
22 dysregulation of the catecholamine system. Clinically documented
23 increases in sleep problems, headaches, dizziness, concentration problems
24 and allergies followed the onset of new microwave transmissions.
25

26 d. Eskander EF, Estefan SF, Abd-Rabou AA. 2011. How does long
27 term exposure to base stations and mobile phones affect human hormone
28 profiles? Clin Biochem 45:157-161. Measured hormone levels in 82
29 mobile phone users and 20 controls over a period of 6 years. Report that
30 there were decreases in ACTH, cortisol, thyroid hormones, and prolactin in
31 young females and testosterone in males. There was no change in serum
32 progesterone in females, but in older females prolactin increased with
33 exposure. Exposure from cell phone base stations was associated with
34 significant decreases in ACTH and cortisol.
35

36 The following studies report changes in male fertility and reproductive systems
37 associated with cell phone and low-level RF exposure.
38

39 a. Wdowiak A, Wdowiak L, Wiktor H. 2007. Evaluation of the effect
40 of using mobile phones on male fertility. Ann Agric Environ Med 14: 169-
41 172. Among Polish males with an infertility problem there was “an
42 increase in the percentage of sperm cells of abnormal morphology
43 associated with duration of exposure to waves emitted by the GSM phone.

1 It was also confirmed that a decrease in the percentage of sperm cells in
2 vital progressing motility in the semen is correlated with the frequency of
3 using mobile phones.”
4

5 b. Agarwal A, Deepinder F, Sharma RK, Ranga G, Li J. 2008. Effect
6 of cell phone usage on semen analysis in men attending infertility clinic: an
7 observational study. *Fert Steril* 89: 124-128.. “Use of cell phones
8 decreases the semen quality in men by decreasing the sperm count,
9 motility, viability, and normal morphology. The decrease in sperm
10 parameters was dependent on the duration of daily exposure to cell phones
11 and independent of the initial semen quality.”
12

13 c. Baste V, Riise T, Moen BE. 2008. Radiofrequency electromagnetic
14 fields: male infertility and sex ratio of offspring. *Int J Epidemiol* 23:369-
15 377. This is a study of Norwegian Navy personnel chronically exposed to
16 RF fields on the job. The rates of infertility were related to level of
17 exposure in a dose-dependent fashion.
18

19 d. Agarwal A, Desai NR, Makker K, Varghese A, et al. 2009. Effects
20 of radiofrequency electromagnetic waves (RF-EMW) from cellular phones
21 on human ejaculated semen: an *in vitro* pilot study. *Fert Stert* 92: 1318-
22 1325. “Radiofrequency electromagnetic waves emitted from cell phones
23 may lead to oxidative stress in human semen. We speculate that keeping
24 the cell phone in a trouser pocket in talk mode may negatively affect
25 spermatozoa and impair male fertility.
26

27 e. LaVignera S, Condorelli RA, Vicari E, D’Adata R, Calogero AE.
28 2012. Effects of the exposure to mobile phones on male reproduction: A
29 review of the literature. *J Androl* 33: 350-356. Studies in animals and
30 humans show that “RF-EMR decreases sperm count and motility and
31 increases oxidative stress....The results showed that human spermatozoa
32 exposed to RF-EMR have decreased motility, morphometric abnormalities
33 and increased oxidative stress, whereas men using mobile phones have
34 decreased sperm concentration, decreased motility (particularly rapid
35 progressive motility), normal morphology and decreased viability. These
36 abnormalities seem to be directly related to the duration of the mobile
37 phone use.”
38

39 f. Avendaño C, Mata A, Sanchez Sarmiento CA, Doncel GF. 2012.
40 Use of laptop computers connected to internet through Wi-Fi decreases
41 human sperm motility and increases sperm DNA fragmentation. *Fert Steril*
42 97:39-45. In this study human sperm were exposed to Wi-Fi from a laptop,
43 and were found to show reduced motility after a 4-hour exposure. The

1 results are consistent with other publications (see Agarwal et al., 2008. Fert
2 Steril 89:124-128) that reported that those who use cell phone regularly
3 have reduced sperm count.
4

5 Other evidence of fertility and reproductive effects of low-level RF exposure is
6 discussed in Section 18 of the *Bioinitiative Report 2012*.

7 Q. Is there evidence that some people may become hyper-sensitive to low-level RF
8 and experience related adverse health effects?

9 Electrical hypersensitivity (EHS) is a syndrome of relatively non-specific
10 complaints that are reported to be associated with exposure to electromagnetic
11 fields. The major symptoms are headache, fatigue, tinnitus, disruption of sleep,
12 mental dullness and a general feeling of ill health. Whether or not EHS exists has
13 been widely debated. In spite of widespread reports that up to 10% of the
14 population may suffer from EHS, most studies in laboratories with blinded
15 exposures (ie., the subjects do not know whether or not the fields are applied) have
16 not demonstrated that persons reporting to be electrosensitive can correctly
17 distinguish when the fields are on. However, there is increasing evidence that
18 EHS does exist and can be a disabling condition for some particularly sensitive
19 persons, although evidence to date is certainly incomplete.

20 There has been only one report of a completely blinded study of an
21 electrosensitive individual that has documented the ability of this individual to
22 report symptoms (primarily headache) in the presence of an electromagnetic field:

23
24 a. McCarty DE, Carrubba S, Chesson AL, Frilor C, Gonzalex-Toledo
25 E, Marino AA. 2011. Electromagnetic hypersensitivity: Evidence for a

1 novel neurological syndrome. Internat J Neurosci 121: 670-676. In a
2 female physician who is electrosensitive, blinded application of
3 electromagnetic fields triggered temporal pain, headache, muscle twitching
4 and skipped heartbeats within 100 seconds of field application.

5
6 There are a number of other reports investigating the prevalence of symptoms in
7 areas near to sources and/or other measures of human response to electromagnetic
8 fields. There are many publications on this subject, and the following are
9 representative of both positive and negative studies:

10
11 a. Hietanen M, Hamalainen A-M, Husman T. 2002. Hypersensitivity
12 symptoms associated with exposure to cellular telephones: No causal link.
13 Bioelectromagnetics 23: 264-270. Studied 20 volunteers who reported
14 themselves to be electrosensitive and exposed them to fields in a blinded
15 manner. "None of the test subjects could distinguish real RF exposure from
16 sham exposures."

17
18 b. Abelin T, Altpeter E, Rösli M. 2005. Sleep disturbances in the
19 vicinity of the short-wave broadcast transmitter Schwarzenburg.
20 Somnologie 9:203-209. There is strong evidence of a causal relationship
21 between operation of a short-wave radio transmitter and sleep disturbances
22 in the surrounding population.

23
24 c. Hutter HP, Moshhammer H, Wallner P, Kundi M. 2006. Subjective
25 symptoms, sleeping problems, and cognitive performance in subjects living
26 near mobile phone base stations. Occup Environ Med 63:307-313. There
27 was a significant relation of some symptoms, especially headaches, to
28 measured power density, as well as effects on wellbeing and performance.

29
30 d. Eliyahu I, Luria R, Hareuveny R, Margalio M, Neiran N, Shani G.
31 2006. Effects of radiofrequency radiation emitted by cellular telephones on
32 the cognitive functions of humans. Bioelectromagnetics 27:119-266. A
33 total of 36 human subjects were exposed to pulse-modulated microwaves
34 and were tested on four distinct cognitive tasks. Exposure to the left side of
35 the brain slows left-hand response time in three of the four tasks.

36
37 e. Altpeter ES, Rösli M, Battaglia M, Pfluger D, Minder CE, Abelin
38 T. 2006. Effect of short-wave magnetic fields on sleep quality and
39 melatonin cycle in humans: The Schwarzenburg shut-down study.

1 Bioelectromagnetics 27:142-150. Sleep quality improved and melatonin
2 excretion increased when the transmitter was shut down.

3
4 f. Preece AW, Georgious AG, Duunn EJ, Farrow SC. 2007. Health
5 response of two communities to military antennae in Cyprus. *Occup*
6 *Environ Med* 64:402-408. Compared to residents of a control village, there
7 was a highly significant excess in the reporting of migraine, headache and
8 dizziness in residents living near to military and cell phone antenna
9 systems.

10
11 g. Barth A, Winker R, Ponocny-Seliger E, Mayrhofer W, Ponocny I,
12 Sauter C, Vana N. 2008. A meta-analysis for neurobehavioural effects due
13 to electromagnetic field exposure emitted by GSM mobile phones. *Occup*
14 *Environ Med* 65: 342-345. The authors looked at 19 studies of cognitive
15 function in cell phone users, and found in the meta-analysis that there is
16 evidence for a decreased reaction time, altered working memory and
17 increased number of errors in exposed persons.

18
19 h. Landgrebe M, Frick U, Hauser S, Langguth B, et al. 2008.
20 Cognitive and neurobiological alterations in electromagnetic hypersensitive
21 patients: results of a case-control study. *Psychol Med* 38: 1781-1791.
22 Studies 89 EHS subjects and 107 age and gender matched controls. Found
23 that discrimination ability was significantly reduced in EHS subjects, while
24 intra-cortical facilitation was decreased in younger, but increased in older
25 EHS subjects. They conclude that there are significant cognitive and
26 neurobiological alterations pointing to a higher genuine individual
27 vulnerability in EHS subjects.

28
29 i. Landgrebe M, Frick U, Hauser S, Hajak G, Langguth B. 2009.
30 Association of tinnitus and electromagnetic hypersensitivity: hints for a
31 shared pathophysiology? *PLoS One* 4: e5026 doi:
32 10.1371/journal.pone.0005026. Tinnitus occurrence and severity were
33 assessed by questionnaire in 89 EHS and 107 control subjects. Tinnitus
34 was significantly more frequent in the EHS group, but there were no
35 differences in severity or duration. They conclude that tinnitus is
36 associated with subjective EHS.

37
38 j. Furubayashi T, Ushiyama A, Teerao Y, Mizuno Y, et al. 2009.
39 Effects of short-term W-CDMA mobile phone base station exposure on
40 women with or without mobile phone related symptoms.
41 *Bioelectromagnetics* 30: 100-113. In a double-blind, cross over study of 11
42 subjects with cell phone-related symptoms and 43 controls, subjected to
43 continuous, intermittent and sham exposure with or without noise, no

1 significant effects were found on any psychological, cognitive or autonomic
2 response.

3
4 k. Dahmen N, Ghezel-Ahmadi D, Engel A. 2009. Blood laboratory
5 findings in patients suffering from self-perceived electromagnetic
6 hypersensitivity (EHS). *Bioelectromagnetics* 30: 299-306. Monitored
7 thyroid hormone, liver enzymes, hemoglobin, hematocrit and c-reactive
8 protein in subjects with and without EHS. "Our results identified
9 laboratory signs of thyroid dysfunction, liver dysfunction and chronic
10 inflammatory processes in small, but remarkable fractions of EHS
11 sufferers."

12
13 l. Eger H, Jahn M. 2010. [Specific health symptoms and cell phone
14 radiation in Selbitz (Bavaria, Germany)- Evidence of a dose-response
15 relationship.] *Umwelt-Medizin-Gesellschaft* 23: 2. Reports on symptoms
16 of individuals based on residential location and RF measurements of local
17 cell phone radiation levels. "For symptoms as sleep problems, depressions,
18 cerebral symptoms, joint problems, infections, skin problems,
19 cardiovascular problems as well as disorder of the visual and auditory
20 systems and the gastrointestinal tract, a significant dose-response
21 relationship was observed in relation to objectively determined exposure
22 levels".

23
24 m. Robertson JA, Théberge J, Weller J, Drost DJ, Prato FS, Thomas
25 AW. 2010. Low-frequency pulsed electromagnetic field exposure can alter
26 neuro-processing in humans. *JR Soc Interface* 7:467-473. A functional
27 magnetic resonance imaging study demonstrated how the neuromodulation
28 effect of extremely low-frequency magnetic fields influences the processing
29 of acute thermal pain. The study concludes that magnetoreception may be
30 more common than presently thought. This study was already filed in the
31 present case as Exhibit C-SE-AQLPA-0043, SE-AQLPA-5, Document 10.

32
33 n. Heinrich S, Thomas S, Heumann C, von Kries R and Radon K.
34 2010. Association between exposure to radiofrequency electromagnetic
35 fields assessed by dosimetry and acute symptoms in children and
36 adolescents: a population based cross-sectional study. *Environ Health* 9: 75
37 doi: 10.1186/1476-069X-9-75. The authors studied 1484 children and 1508
38 adolescents with radiofrequency exposure monitored by a personal
39 dosimeter. Self-reported statistically significant effects found include
40 increased headache (OR 1.50, 1.03-2.19), greater irritation in the evening
41 (OR 1.79, 1.23-2.61) and higher concentrations problems (OR = 1.55, 1.02-
42 2.33) in individuals with greater exposures. However, many others
43 measures did not lead to statistically significant associations.

1
2 o. Mohler E, Frei P, Braun-Fahrlander C, Frohlich J, et al. 2010.
3 Effects of everyday radiofrequency electromagnetic field exposure on sleep
4 quality: A cross-sectional study. *Rad Res* 174: 347-356. Studied 1375
5 inhabitants of Basel with a questionnaire and using a prediction model of
6 exposure. "Neither mobile phone use nor cordless phone use was
7 associated with decreased sleep quality."

8
9 p. Roosli M, Frei P, Mohler E, Hug K. 2010. Systematic review on the
10 health effects of exposure to radiofrequency electromagnetic fields from
11 mobile phone base stations. *Bull World Health Organ* 88: 887-896.
12 Reviewed 17 publications on non-specific symptoms of ill health from RF
13 exposure from mobile phone base stations, and concluded that "At present
14 there is insufficient data to draw firm conclusions about health effects from
15 long-term low-level exposure typically occurring in the everyday
16 environment."

17
18 q. Papageorgiou CC, Hountala CD, Maganioti AE, Kyprianou MA,
19 Rabavilas AD, Papadimitriou GN, Capsalis CN. 2011. Effects of wi-fi
20 signals on the p300 component of event-related potentials during an
21 auditory Hayling task. *J Integr Neurosci* 10:189-202. The Hayling
22 Sentence Completion test was used to evaluate response initiation and
23 response inhibition. This study concludes that WI-FI exposure may exert
24 gender-related alterations on neural activity.

25
26 r. Oshima N, Nishida A, Shimodera S, Tochigi M, et al. 2012. The
27 suicidal feelings, self-injury, and mobile phone use after lights out in
28 adolescents. *J Pediatr Psychol* 37: 1023-1030. Studied 17,920 adolescents
29 using a self-report questionnaire. "Logistic regression showed significant
30 associations of the nocturnal mobile phone use with poor mental health,
31 suicidal feelings, and self-injury after controlling for sleep length and other
32 confounders."... "A mechanism of the association might be worsening of
33 the quality of sleep."

34
35 In summary, some studies are suggestive of an association, but the reported
36 evidence falls short of proof. In the context of exposure to RF emissions from
37 smart meters, there is a substantial body of evidence from the personal accounts of
38 utility customers who report experiencing EHS symptoms. This evidence should

1 not be disregarded in setting public policy that will determine whether and to what
2 extent people are exposed to these devices.

3 Further discussion of studies of EHS effects can be found in Sections 6 and
4 8 of the Bioinitiative Report 2012.

5 Q. Is there evidence that brain cancer rates have increased in recent decades?

6 A. If use of cell phones causes brain cancer, then one might expect that overall rates
7 of brain cancer would show an increase, since cell phone use has grown
8 enormously in recent years. However, since use of cell phones is relatively recent
9 and the latency for development of brain cancer following other environmental
10 exposures is long (up to 20-30 years), there might not yet be a clear pattern of
11 increased incidence. The following studies address this issue:

12
13 a. Central Brain Tumor Registry of the United States (CBTRUS).
14 Supplemental Report: Primary Brain Tumors in the United States, 2004.
15 Hinsdale, IL; Central Brain Tumor Registry of the United States 2008.
16 Age-adjusted CNS tumor incidence was 18.2 cases per 100,000 in 2004,
17 but 13.4 cases per 100,000 in 1995.

18
19 b. Lehrer S, Green S, Stock RG. 2010. Association between number of
20 cell phone contracts and brain tumor incidence in nineteen U.S. states. J
21 Neuro-Oncol 101:505-507. "The effect of cell phone subscriptions was
22 significant ($P = 0.017$), and independent of effect of mean family income (P
23 $= 0.894$), population ($P = 0.003$) and age (0.499). The very linear
24 relationship between cell phone usage and brain tumor incidence is
25 disturbing and certainly needs further epidemiological evaluation. In the
26 meantime, it would be prudent to limit exposure to all source of electro-
27 magnetic radiation."

28
29 c. De Vocht F, Burstyn I, Cherrie JW. 2011. Time trends (1998-2007)
30 in brain cancer incidence rates in relation to mobile phone use in England.
31 Bioelectromagnetics 32:334-339. "There were no time trends in overall
32 incidence of brain cancers for either gender, or any specific age groups.

1 Systematic increases in rates for cancer of the temporal lobe in men... and
2 women... were observed, along with decreases in the rates of cancer of the
3 parietal lobe... and cerebellum...”

4
5 d. Little MP, Curtis RE, Devesa SS, Inskip PD, et al. 2012. Mobile
6 phone use and glioma risk: comparison of epidemiological study results
7 with incidence trends in the United States. *BMJ* 344: e1147 doi:
8 10.1136/bmj.e1147. “Raised risks of glioma with mobile phone use, as
9 reported by one (Swedish) study forming the basis of the IARC’s re-
10 evaluation of mobile phone exposure, are not consistent with observed
11 incidence trends in US population data, although US data could be
12 consistent with the modest excess risks in the Interphone study.”

13
14 e. Dobes M, Shadbolt B, Khurana VG, Jain S, et al. 2011. A
15 multicenter study of primary brain tumor incidence in Australia (2009-
16 2008). *Neuro-Oncol* 13: 783-790. The authors observed an increased
17 increase in malignant primary brain tumors over the period 2000-2008, but
18 cannot determine whether it was due to improved detection, diagnosis or to
19 a true elevated incidence.

20
21 f. Deltour I, Auvienne A, Feychting M, Johansen C, et al. 2012. Mobile
22 phone use and incidence of glioma in the Nordic countries 1979-2008.
23 *Epidemiology* 23:301-307. “No clear trend change in glioma incidence
24 rates was observed. Several of the risk increases seen in case-control
25 studies appear to be incompatible with the observed lack of incidence rate
26 increase in middle-aged men. This suggests longer induction periods than
27 currently investigated, lower risks than reported from some case-control
28 studies, or the absence of any association.”

29
30 g. The Danish Cancer Society recently reported that the number of men
31 who are diagnosed with the most malignant form of brain cancer
32 (glioblastoma) has almost doubled over the past ten years.
33 ([http://www.cancer.dk/Nyheder/nyhedsartikler/2012kv4/Kraftig+stigning+i](http://www.cancer.dk/Nyheder/nyhedsartikler/2012kv4/Kraftig+stigning+i+hjernesvulster.htm)
34 [+hjernesvulster.htm](http://www.cancer.dk/Nyheder/nyhedsartikler/2012kv4/Kraftig+stigning+i+hjernesvulster.htm))

35
36 Further discussion of the relevance of brain cancer rates to the debate about the
37 association between cell phone and RF exposure to cancer is found in Section 11
38 of the *Bioinitiative Report, 2012*.

1 Q. In addition to the foregoing evidence of the effects of low-level RF on humans, is
2 there additional evidence from studies of animals and isolated cells?

3 A. Some, but not all studies of isolated cells and intact animals have shown that
4 RF/MW exposures may cause changes in cell membrane function, cell
5 communication, metabolism, activation of proto-oncogenes, and can trigger the
6 production of stress proteins at exposure levels below the above FCC and Health
7 Canada guidelines. Resulting effects in cellular studies include DNA breaks and
8 chromosome aberrations, cell death including death of brain neurons, increased
9 free radical production, activation of the endogenous opioid system, cell stress and
10 premature aging. Additional studies show neurologic, immune, endocrine,
11 reproductive and cardiac, adverse health effects from low-dose, chronic exposure
12 to RF/MW radiation in humans. These studies will not be presented here because
13 there are too many and their relevance to human health is uncertain. Please see
14 Bioinitiative Report, 2012 for a comprehensive review of these studies. In
15 summary they do provide additional evidence of biological effects and evidence
16 for possible mechanisms whereby radiofrequency fields may cause adverse health
17 effects including cancer, reproductive and neurobehavioral effects through
18 generation of reactive oxygen species, gene induction and alteration of ion fluxes,
19 but not all positive observations have been fully replicated.

20 **Q. Are there any safety standards or guidelines governing RF devices in the**
21 **United States that are designed to protect people from non-thermal effects of**
22 **RF exposure?**

1 A. The standards set by the US Federal Communications Commission (FCC)
2 and most international government and non-government organizations are based
3 on the fallacious assumption that there are no adverse human health effects from
4 radiofrequency radiation that does not cause measureable heating. These
5 standards provide no protection whatsoever against non-thermal effects of RF.
6 Some biological effects are known to occur at several hundred thousand times
7 below the FCC public exposure guidelines and the similar guidelines of Health
8 Canada's Safety Code no. 6 (of 6,000,000 $\mu\text{W}/\text{m}^2$ or 600 $\mu\text{W}/\text{cm}^2$ for the 902-928
9 MHz bandwidth), as documented in the 2012 *Biointiative Report*, Section 24. It
10 is further to be noted that FCC guidelines also apply to 30-minute averaging and
11 Health Canada's Safety Code no. 6 applies to 6-minute averaging. There is no
12 evidence that averaging exposures over time is appropriate for assessing maximum
13 exposure limits to low-level RF.

14 Furthermore, these limits are based on the incorrect biological assumption
15 that body temperatures must increase at least 1°C to lead to potential biological
16 impacts and the impacts of absorbing RF within the band of the electromagnetic
17 spectrum that smart meters use would only be limited to behavioral disruption.
18 These limits do not take into account the scientific research that show tissue
19 heating may result in many adverse health effects other than "behavioral
20 disruption". These limits also do not take into account the accepted biological fact
21 that every enzyme system in the body is exquisitely sensitive to temperature and
22 may increase activity by even a fraction of a degree increase in temperature. What

1 is defined as “non-thermal” effect is therefore partly a function of our ability to
2 measure the temperature increase. *See Bioinitiative Report*, Section 24 for further
3 discussion.

4 FCC public RF/MW radiation exposure guidelines (and the similar Health
5 Canada Safety Code no. 6 guidelines) are based on the height, weight and stature
6 of a 6-foot tall man, not children or adults of smaller stature. The guidelines do not
7 take into account the unique susceptibility of growing children to RF/MW
8 radiation exposures. Since children are growing, their rate of cellular activity and
9 division is more rapid, and they are at a greater risk for DNA damage and
10 subsequent cancers. Growth and development of the central nervous system is still
11 occurring well into the teenage years, such that the neurological impairments
12 predictable by the extant science may have great impact upon development,
13 cognition, learning, and behavior.

14 **Q. Have you reviewed the joint testimony of William H. Bailey, Ph.D. and Yakov**
15 **Shkolnikov, Ph.D., dated September 19, 2012?**

16 **A. Yes.**

17 **Q. In their testimony, Dr. Bailey and Dr. Shkolnikov cite a report by the**
18 **ICNIRP Committee, which concluded that “the trend in the accumulated**
19 **evidence is increasingly against the hypothesis that mobile phone use causes**
20 **brain tumors.” Do you agree with that conclusion?**

21 **A. I strongly disagree. The weight of evidence indicates that mobile phone use is**
22 **associated with elevated risk of brain cancer which becomes apparent after ten or**

1 more years of intensive use and occurs primarily on the side of the head where the
2 user holds his/her phone the majority of the time. There is emerging evidence that
3 younger people are at greater risk than older individuals. The great majority of the
4 meta-analyses that have been published on the subject demonstrate a statistically
5 significant elevation in rates of brain cancer with long-term cell phone use. This
6 statement by Bailey and Shkolnikov is simply not true.

7 It is necessary to comment on the ICNIRP report, as well as on the UK
8 Advisory Group on Non-Ionising Radiation (AGNIR) report, published in April,
9 2012, which is also cited by Bailey and Shkolnikov. It should be noted that there
10 is considerable overlap in the membership of these two groups. Both ignore or
11 attempt to discredit the information presented above. The AGNIR report fails to
12 even mention the IARC classification of radiofrequency fields as possible human
13 carcinogens. Neither is a fair and balanced review of the scientific evidence
14 concerning the human health effects of radiofrequency fields. A much more
15 convincing review of the evidence is found in the Ramazzini Institute European
16 Journal of Oncology Library, Volume 5, entitled "Non-thermal effects and
17 mechanisms of interaction between electromagnetic fields and living matter,"
18 published in 2010, and in the *Bioinitiative Report, 2012*. The primary reason that I
19 and the other authors prepared the *Bioinitiative Report* was and is to counter the
20 prejudicial and false conclusions of these reports, and to do so by presenting a
21 comprehensive review of scientific evidence.

1 Q. Do you agree with their testimony that the authors of the *Bioinitiative Report*
2 used flawed methods and failed to follow “the standard, scientific methods for
3 developing exposure limits.”

4 A. I strongly disagree with this statement. It should be noted that the *Bioinitiative*
5 *Report* does not recommend exposure limits *per se*, but rather identifies exposures
6 levels which are associated with biological effects, some of which are adverse
7 effects on human health. The public health chapter, of which I am a co-author,
8 identifies a “no observed effect level” (NOEL), based on the scientific evidence
9 from peer-reviewed scientific studies, then applies safety factors for sensitive
10 populations (the fetus, children, the aged, etc.) as is standard practice in chemical
11 risk assessment. This chapter presents clear documentation of why more stringent
12 limits on exposure are necessary to protect human health.

13 The *BioInitiative Report* is aimed at *restoring* the balance, by providing a
14 more comprehensive review of the evidence. The *Bioinitiative Report* mentions
15 many negative reports, discusses the weight of evidence, and looks for
16 inconsistencies. For example, Prof. Henry Lai of the University of Washington in
17 the 2012 *Bioinitiative Report* presents summaries of 86 scientific studies on
18 genotoxic effects of radiofrequency radiation published since 2007, and finds that
19 63% of these found statistically significant positive effects, while of 155 new
20 studies on neurological effects, 98 found effects. The *Bioinitiative Report*, unlike
21 either the ICNIRP or AGNIR reports, reviews of the scientific research available,
22 both those showing and not showing biological effects and human disease, and

1 draws conclusions based on the weight of the evidence that standard setting
2 organizations were failing to properly take into account.

3
4 **Q. Dr. Bailey and Dr. Shkolnikov testified that: “The weight of the evidence does**
5 **not support the idea that significant biological or adverse health effects can**
6 **occur” from RF exposure. Do you agree with this conclusion?**

7 A. This statement is almost incomprehensible given the strength of the evidence
8 demonstrating consistent and serious adverse health effects in both animal and
9 human studies. The studies of greatest importance are those which demonstrated
10 elevations in cancers, especially leukemia and brain cancer, in association with
11 exposure to radiofrequency EMFs. There is evidence that exposure to cell phone
12 frequencies increased uptake of glucose in the brain, which indicates that RF
13 radiation alters fundamental process within the nervous system. The thousands of
14 studies in cellular and animal systems provide additional evidence that
15 radiofrequency fields alter a host of biochemical, physiological and behavioral
16 factors. While certainly not every study reports positive and statistically
17 significant results, the majority do as clearly documented in the 2012 *Bioinitiative*
18 *Report*. No objective person could possibly make a statement such as this if they
19 are at all familiar with the literature published in high-quality, peer-reviewed
20 scientific journals, and if they are coming to the question with an open mind
21 without a major conflict of interest.

1 Standards setting organizations aimed at regulating RF exposure have for a
2 long time been dominated by physicists and engineers, often with close ties with
3 the industry, with little input from biological and medical science. In spite of
4 evidence to the contrary, many such people have as a statement of faith that RF
5 fields that do not cause measureable tissue heating cannot have biologic effects.
6 This point of view is incompatible with the science. Standards setting
7 organizations also often explicitly take into account the economic impacts of the
8 standards when faced with scientific uncertainty. Both because of their training
9 and because of their ties with the industry, members of most of these organizations
10 have been reluctant to take the above biological findings into account when
11 proposing exposure limits.

12 These organizations have generally refused to accept epidemiological and
13 laboratory research findings linking RF electromagnetic fields exposure with
14 various non-thermal biological effects, as being inconclusive and requiring further
15 research. The difficulty stems from the fact that, although links have been
16 demonstrated repeatedly between RF electromagnetic fields exposure and non-
17 thermal biological effects in humans, there is a lack of a comprehensive biological
18 theory explaining why these effects take place, and therefore causality cannot, at
19 the present time, be demonstrated with certainty. Animals do not always respond
20 to RF electromagnetic fields as do humans. Also, in some cases, experimental
21 results in cellular studies have not been replicated in other laboratories; in some
22 cases attempts to duplicate results showed negative results or variations in the

1 results. These discrepancies are, however, normal in the research process and may
2 result from slight, but significant differences in procedures; they indicate that
3 biological systems are complex and that different variables need to be isolated in
4 order to fully understand these systems. Research is still needed in order to
5 determine to what extent non-thermal biological effects may vary with frequency,
6 with modulation and depend on the pulsed (instead of continuous) character of RF
7 emissions. There may also be variance between the levels of reaction of different
8 subjects for reasons that still remain to be explained. This is what the research
9 process is about. In biology and medicine there is nothing that is 100% proven;
10 our understanding of various illnesses, cancer and Alzheimer's, for example, is
11 still largely incomplete. We rely on statistical significance and weight of evidence
12 and, therefore, on judgment, when drawing conclusions about health effects.

13 **Q. In your opinion, could a careful scientist familiar with the body of knowledge**
14 **on the subject reliably conclude that there are no risks of adverse health**
15 **effects from the exposure to RF in the 2.4 GHz range?**

16 A. On the basis of the vast body of scientific literature, many public health experts,
17 myself included, are of the opinion that exposure to RF/MW radiation and EMFs,
18 including in the range of 2.4GHz, poses a potential of serious threat to public
19 health. The degree of risk will vary with both the intensity and duration of
20 exposure. It is likely society will face markedly increased incidence of neurotoxic
21 effects, neurodegenerative diseases, cancers and genotoxicity in the future,

1 resulting from the extreme and mostly involuntary exposure to RF/MW radiation
2 and EMFs.

3 **Q. Are you familiar with smart meter technology?**

4 A. I am familiar with smart meter technology.

5 **Q. In your opinion, could a careful scientist familiar with the body of knowledge**
6 **on the subject reliably conclude that there are no risks of adverse health**
7 **effects from exposure to RF from smart meters emitting RF radiation in the**
8 **2.4 GHz range with peak power densities of approximately 0.44 mW/cm²?**

9 A. There are two types of smart meter technology. Wired smart meters pose no risk
10 of exposure to RF radiation. Wireless smart meters, on the other hand, pose a
11 substantial risk of RF exposure which is dependent on the frequency of pulsed RF,
12 the intensity of the pulsed RD and the individual's distance from the meter. While
13 there have not been human health studies done to date of the effects of exposure to
14 smart meter RF, because the technology is too new and the latency for adverse
15 effects for diseases such as cancer is long, the evidence from the cell phone studies
16 demonstrates convincingly that wireless smart meters pose a risk to human health.

17 Smart meters send pulsed RF radiation at intermittent periods of time.
18 While the frequency of these pulses may vary with different smart meters, some
19 have been reported to send pulses over 30 times a minute at peak power density
20 reading of over 67mW/m² (0.0067mW/cm²) (Maisch, 2012. Smart meter health
21 concerns: Just a nocebo effect or an emerging public health nightmare? ACNEM
22 Journal 31: 15-19), and this exposure has been associated with self-reported

1 experimental studies that provide some of the evidence of low intensity exposure
2 effects from radiofrequency radiation at low-intensity exposures. Because the
3 meters operate intermittently 24/7, an individual in the vicinity of the meter will be
4 continuously exposed to RF.


5 It is correct that the CMP smart meters comply with the FCC standard of 1
6 mW/cm². The problem is that the FCC standard is based on the assumption that
7 there are no effects of RF radiation other than tissue heating, which is simply not
8 the case.

9 For most smart meter use, the cumulative average RF exposure is not great,
10 but the reported health effects are large. This raises the important question as to
11 whether the exposure of greatest concern is the cumulative average, or rather the
12 peak power levels in the pulses. This issue is discussed in Chapter 24 of the 2012
13 *Biointiative Report*, which presents some evidence that it is the peak power that is
14 important. However, the total exposure will only increase in the future as RF
15 devices are being placed in every appliance in the home, and will use RF to
16 communicate to the smart meter which will communicate with the utility. This
17 will make the home, especially the kitchen, a source of highly elevated RF
18 exposure whenever an appliance is used.

19 Further investigation of the human health effects of smart meter exposures
20 is essential. In the meantime it is extremely unwise to implement the smart grid
21 with wireless smart meters until we understand fully the potential for harm to
22 human health.

1

Dated this 18th day of January, 2013.

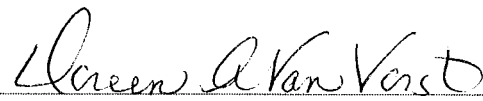


David O. Carpenter, M.D.

STATE OF NEW YORK
RENSSELAER, ss:

January 22, 2013

Personally appeared the above-named David O. Carpenter, M.D., and stated under oath that the foregoing Affidavit made by him is true and based upon his own personal knowledge, information or belief, and so far as upon information and belief, he believes the information to be true. Before me,



Notary Public/Attorney-at-Law
Doreen A. VanVorst

Name Typed or Printed
My Commission Expires: _____

DOREEN A. VanVORST
Notary Public, State of New York
Qualified in Rensselaer County
Reg. No. 01VA5083834
My Commission Expires Aug. 25, 2013

**DAVID CARPENTER
EXHIBIT A**

CURRICULUM VITAE

Name: David O. Carpenter

Home Address: 2749 Old State Road
Schenectady, New York 12303

Positions Held:
Director, Institute for Health and the Environment
University at Albany
Professor, Environmental Health Sciences
School of Public Health, University at Albany
5 University Place, A217, Rensselaer, NY 12144

Honorary Professor
Queensland Children's Medical Research Institute
University of Queensland
Brisbane, Australia

Education: 1959 B.A., Harvard College, Cambridge, MA
1964 M.D., Harvard Medical School, Boston, MA

Positions Held:

9/61-6/62 Research Fellow, Department of Physiology, University of Göteborg, Sweden with Professor Anders Lundberg

7/64-6/65 Research Associate, Department of Physiology, Harvard Medical School, Boston, MA under the direction of Dr. Elwood Henneman

7/65-2/73 Neurophysiologist, Laboratory of Neurophysiology, National Institutes of Mental Health, Dr. Edward V. Evarts, Chief, Assistant Surgeon, USPHS, currently a Reserve Officer in the USPHS.

2/73-3/80 Chairman, Neurobiology Department Armed Forces Radiobiology Research Institute, Defense Nuclear Agency, Bethesda, MD

3/80-9/85 Director, Wadsworth Center for Laboratories and Research, New York State Department of Health, Albany, NY

9/85-1/98 Dean, School of Public Health, University at Albany

9/85-Pres. Professor, Departments of Environmental Health Sciences and Biomedical Sciences, School of Public Health, University at Albany.

9/85-7/98 Research Physician, Wadsworth Center for Laboratories and Research, New York State Department of Health, Albany, NY

1/98-1/05 Adjunct Professor in the Center for Neuropharmacology & Neuroscience, Albany Medical College, Albany, NY

2001-Pres. Director, Institute for Health and the Environment, University at Albany, SUNY, Rensselaer, NY. The Institute was named a Collaborating Center of the World Health Organization in 2011.

2005-Pres. Senior Fellow, Alden March Bioethics Institute, Albany Medical College/Center, Albany, New York

DAVID CARPENTER EXHIBIT A

Editor-in-Chief: Cellular and Molecular Neurobiology, 1981 – 1987
Editor-in Chief: Reviews on Environmental Health 2012-present
Editor-in-Chief: Journal of Local and Global Health Sciences 2012-present
Editorial Advisor: Cellular and Molecular Neurobiology, 1987 - Present
Editorial Boards: Journal of Public Health Management and Practice, 1995 - 2002
International Journal of Occupational Medicine & Environmental Health
1996 – Present
Journal of Alzheimer's Disease – Associate Editor, 2007-2009
Reviews in Environmental Health; 2008-2012
International Archives of Occupational and Environmental Health; 2009-present.
Journal of Environmental and Public Health, 2009-present.
Environmental Health Perspectives, 2010-present
Global Health Perspective, 2012-present

National and International Committees:

1978, 1981 Physiology Study Section (Ad hoc member)
1979-1985 NIH International Fellowship Study Section
1974-1981 Member, Steering Committee of the Section on the Nervous System, American Physiological Society (Chairman of the Committee, 9/76-4/80)
1981-1989 Member, USA National Committee for the International Brain Research Organization
1985-1986 Committee on Electric Energy Systems of the Energy Engineering Board, National Research Council
1986-1987 Member, Neurophysiology Peer Panel for the National Aeronautics and Space Administration
1987-1989 Member, Science Advisory Council of the American Paralysis Association
1987-1990 Advisory Panel for the Electric Energy System Division, U.S. Department of Energy
1985-1993 Committee #79, National Council on Radiation Protection and Measurements
1986-1997 Member, Legislative and Education Committees, Association of Schools of Public Health
1989-1994 Member, Neuroscience Discipline Working Group, Life Sciences Division of the NASA
1994, 1995 Federation of American Societies for Experimental Biology Consensus Conference on FY 1995 Federal Research Funding
1994-1997 Member, Legislative Committee of the Association of Schools of Public Health
1997 Member, Executive Committee of the Association of Schools of Public Health
1997-2000 National Advisory Environmental Health Sciences Council of the National Institutes of Health
1998-Pres. Member, U.S. Section of the Great Lakes Science Advisory Board of the International Joint Commission
2000-Pres. Member, Board of Directors, Pacific Basin Consortium for Hazardous Waste Health and Environment; Treasurer, 2001-2004, 2008-pres; Chair, 2004-2008
2001-2008 United States Co-Chair, Workgroup on Ecosystem Health of the Science Advisory Board of the International Joint Commission
2002-2003 Member, Committee on the Implications of Dioxin in the Food Supply, The National Academies, Institute of Medicine
2003-2008 Member, United States Environmental Protection Agency, Children's Health Protection Advisory Committee
2003-Pres. Chair, Advisory Committee to the World Health Organization and National Institute of Environmental Health Sciences on collaborative activities.
2004-Pres. Member, Blue Ocean Institute Curriculum Advisory Board.
2007-2011 Chair, Workgroup on Risks vs. Benefits of Fish Consumption, Science Advisory Board, International Joint Commission.

DAVID CARPENTER EXHIBIT A

State and Local Committees:

1980-1987	Executive Secretary, New York State Power Lines Project
1985-1989	Board of Scientific Advisors, Institute of Basic Research, OMRDD, N.Y.
1986-1989	Member, Steering Committee, Health Policy and Administrative Consortium of the Capital District
1991-1992	Member, Connecticut Academy of Sciences and Engineering Committee on Electromagnetic Field Health Effects
1991-1992	Member, Board of Directors of the Capital District Chapter of the Alzheimer's Disease and Related Disorders Association, Inc.
1991-1992	Member, State Task Force for the Reform of Middle Level Education in NY State
1992-1993	Member, State Needs Task Force on Health Care and Education
1987-1998	Delegate-at-Large, New York State Public Health Association
1991-1995	Member, Board of Directors of the Capital District Amyotrophic Lateral Sclerosis Association
1994	Chair, Council of Deans, University at Albany, SUNY
1997-2008.	Member, Board of Directors, (Chair 1998-2004) Albany-Tula Inc.: A Capital Region Alliance
2000-Pres.	Member, Board of Directors, Healthy Schools Network, Inc.
2000-2003	Member, Medical Advisory Board, Hepatitis C Coalition, New York
2000-2004	Member, Environmental Protection Agency /National Association of State Universities and Land Grant Colleges Task Force
2001-2008	Member, Board of Directors, Environmental Advocates of New York
2004-2007	Member, Ad Hoc Advisory Group on Brownfield Cleanup Standards
2005-Pres.	Member, Schooling Chefs Curriculum Advisory Board
2005-Pres.	Member, Advisory Board, Healthy Child Healthy World
2005-2008	Member, Board of Directors, Citizens Environmental Coalition
2006-2009	Member, Board of Directors, Marine Environmental Research Institute
2007-2009	Member, New York State Renewable Energy Task Force

Honors, Awards and Fellowships:

1959	B.A. awarded <u>magna cum laude</u> . Thesis entitled "Metamorphosis of visual pigments: A study of visual system of the salamander, <u>Ambystoma tigrinum</u> " (Thesis advisor, Professor George Wald) Elected to Phi Beta Kappa and to Sigma Xi
1964	M.D. awarded <u>cum laude</u> for a thesis in a special field. Thesis entitled "Electrophysiological observations on the importance on neuron size in determining responses to excitation and inhibition in motor and sensory systems" (Thesis advisor, Dr. Elwood Henneman)
1964	Awarded the Leon Resnick Prize given to a Harvard Medical School graduate showing promise in research
1970	Awarded the Moseley Traveling Fellowship for study in England (Fellowship declined)
1971	Invited as Visiting Professor of Physiology, Centro de Investigacion y de Estudios Avanzados, del Institute Politecnico Nacional, Mexico 14, D.F., Mexico, for 3 months
1982, 1986	Visiting Professor of Physiology, Department of Physiology, Kyushu
1987	University, Fukuoka, Japan, for a period of three months each
1989	Awarded Jacob Javits Neuroscience Investigator Award from the National Institute of Neurological and Communicative Diseases and Stroke
1999	Awarded Homer N. Calver Award from the American Public Health Association for studies

DAVID CARPENTER EXHIBIT A

- in environmental health.
- 2001 Awarded 2001 Academic Laureate from the University at Albany Foundation.
- 2010 Awarded the Albion O. Bernstein, M.D. Award in recognition of an outstanding contribution to public health and the prevention of disease through lifelong research of environmental health hazards and for limitless devotion to medical education by the Medical Society of the State of New York.
- 2011 Awarded the Rodney Wylie Eminent Visiting Fellowship 2011 at the University of Queensland, Brisbane, Australia for a period of four weeks.

Federal Grants Held: (Principal Investigator Only)

- 1980-1983 United States Air Force, "Mechanisms of Radiation-Induced Emesis in Dogs", \$76,847 total direct costs.
- 1982-1988 National Institute of Health, "Mechanisms of Desensitization at Central Synapses", \$464,786 total direct costs.
- 1984-1986 Defense Nuclear Agency, "Mechanisms of Radiation-Induced Emesis in Dogs", \$330,504 total direct costs.
- 1986-1996 National Institute of Health, "Mechanisms of Excitatory Amino Acids Actions and Toxicity", 1986-1989 \$231,848 total direct costs; 1990-1996 \$562,926 total direct costs.
- 1989-1993 National Institute of Health, "Mechanisms of Lead Neurotoxicity" \$373,576 total direct costs
- 1990-1995 National Institute of Environmental Health Sciences, Superfund Basic Research Program, "Multidisciplinary Study of PCBs and PCDFs at a Waste Site", D.O. Carpenter, P.I. \$5,783,419 total direct costs.
- 1995-2001 Fogarty International Center, National Institutes of Health, International Training Program in Environmental and Occupational Health. A Central/Eastern European Environ/Occup Training Program, D.O. Carpenter, P.I. \$657,520 total costs.
- 1995-2001 National Institute of Environmental Health Sciences, Superfund Basic Research Program, "Multidisciplinary Study of PCBs," D.O. Carpenter, P.I. \$12,653,709 total direct costs.
- 1998-1999 Environmental Protection Agency, A Indoor Air Risk at Akwesasne - Pilot Project, D.O. Carpenter, P.I. \$9,996 total costs.
- 2000-2002 Association Liaison Office for University Cooperation in Development, A Cooperative Program in Environmental Health between the Institute of Public Health at Makerere University, Kampala, Uganda and the School of Public Health, University at Albany, USA, D.O. Carpenter, P.I. \$96,432 total costs.
- 2001-2007 Fogarty International Center, National Institutes of Health, International Training Program in Environmental and Occupational Health. A Multidisciplinary Environmental Health Training, D.O. Carpenter, P.I. \$850,000 total costs.
- 2006-2011 Pakistan-US Science and Technology Cooperative Program (US National Academy of Sciences). "Association of particulate matter with daily morbidity in an urban population," D.O. Carpenter, P.I., \$391,104 total costs.
- 2009-2013 Exploratory Center on Minority Health and Health Disparities in Smaller Cities. Project 2: Environmental contaminants and reproductive health of Akwesasne Mohawk women.

DAVID CARPENTER EXHIBIT A

\$387,825 for year 1. D.O. Carpenter, Co-PI.

- 2010-2013 Department of the Army, "Gulf War Illness: Evaluation of an Innovative Detoxification Program: D.O. Carpenter, P.I., \$636,958 total costs.
- 2010-2013 Higher Education for Development of the United States Agency for International Development, "Drinking Water Supply, Sanitation, and Hygiene Promotion : Health Interventions in Two Urban Communities of Kampala City and Mukono Municipality, Uganda". D. O. Carpenter, P.I., \$299,736 total costs.
- 2011-2016 National Institute of Environmental Health Sciences (1RO1ES019620), "Protecting the health of future generations: Assessing and preventing exposures." PK Miller, FA von Hippel, CL Buck and DO Carpenter, Co-P.I.s, \$471,521 for the period 8/08/11-4/30/12, \$2,354,871 for the period 2011-2016.

Research Interests:

- Exposure to persistent organic pollutants and risk of diabetes, cardiovascular disease, and hypertension.
- Cognitive and behavioral effects of environmental contaminants on children (IQ, ADHD) and older adults (dementias, Parkinson's Disease and ALS).
- Ionizing and non-ionizing radiation biology.
- Effects of air pollution on respiratory and cardiovascular function.

Other Professional Activities:

Host, The Public Radio Health Show (a 30 min public health information show carried on 170+ stations nationwide), plus the Armed Forces Radio Network and Voice of America, 1985-2001.

Authored a biweekly health column in The Troy Record, a local newspaper, 1997-1999.

Major Peer-Reviewed Publications:

1. Carpenter, D.O., Lundberg, A. and Norrsell, U. Effects from the pyramidal tract on primary afferents and on spinal reflex actions to primary afferents. Experientia, 18:337, 1962.
2. Carpenter, D.O., Engberg, I. and Lundberg, A. Presynaptic inhibition in the lumbar cord evoked from the brain stem. Experientia, 18:450, 1962.
3. Carpenter, D.O., Lundberg, A. and Norrsell, U. Primary afferent depolarization evoked from the sensorimotor cortex. Acta Physiol. Scand., 59:126-142.
4. Carpenter, D.O., Engberg, I., Funkenstein, H. and Lundberg, A. Decerebrate control of reflexes to primary afferents. Acta Physiol. Scand., 59:424-437, 1963.
5. Carpenter, D.O., Engberg, I. and Lundberg, A. Differential supraspinal control of inhibitory and excitatory actions from the FRA to ascending spinal pathways. Acta Physiol. Scand., 63:103-110, 1965.
6. Henneman, E., Somjen, G.G. and Carpenter, D.O. Excitability and inhibibility of motoneurons of different sizes. J. Neurophysiol., 28:599-620, 1965.

**DAVID CARPENTER
EXHIBIT A**

7. Henneman, E., Somjen, G.G. and Carpenter, D.O. Functional significance of cell size in spinal motoneurons. J. Neurophysiol., 28:560-580, 1965.
8. Somjen, G.G., Carpenter, D.O. and Henneman, E. Selective depression of alpha motoneurons of small size by ether. J. Pharmacol., 148:380-385, 1965.
9. Somjen, G., Carpenter, D.O. and Henneman, E. Response of motoneurons of different sizes to graded stimulation of supraspinal centers of the brain. J. Neurophysiol., 28:958-965, 1965.
10. Carpenter, D.O., Engberg, I. and Lundberg, A. Primary afferent depolarization evoked from the brain stem and the cerebellum. Arch. Ital. Biol., 104:73-85, 1966.
11. Carpenter, D.O. and Henneman, E. A relation between the threshold of stretch receptors in skeletal muscle and the diameter of axons. J. Neurophysiol., 29:353-368, 1966.
12. Carpenter, D.O. Temperature effects on pacemaker generation, membrane potential, and critical firing threshold in Aplysia neurons. J. Gen. Physiol., 50:1469-1484, 1967.
13. Chase, T.N., Breese, G., Carpenter, D., Schanberg, S. and Kopin, I. Stimulation-induced release of serotonin from nerve tissue. Adv. Pharmacol., 6A:351-364, 1968.
14. Carpenter, D.O. and Alving, B.O. A contribution of an electrogenic Na^+ pump to membrane potential in Aplysia neurons. J. Gen. Physiol., 52:1-21, 1968.
15. Olson, C.B., Carpenter, D.O. and Henneman, E. Orderly recruitment of muscle action potentials. Arch. Neurol., 19:591-597, 1968.
16. Carpenter, D.O. Membrane potential produced directly by the Na^+ pump in Aplysia neurons. Comp. Biochem. Physiol., 35:371-385, 1970.
17. Carpenter, D.O. and Gunn, R. The dependence of pacemaker discharge of Aplysia neurons upon Na^+ and Ca^{++} . J. Cell. Physiol., 75:121-127, 1970.
18. Kraus, K.R., Carpenter, D.O. and Kopin, I. R. Acetylcholine-induced release of norepinephrine in the presence of tetrodotoxin. J. Pharmacol. Exp. Therap., 73:416-421, 1970.
19. Barker, J.L. and Carpenter, D.O. Thermosensitivity of neurons in the sensorimotor cortex of the cat. Science, 169:597-598, 1970.
20. Carpenter, D.O., Hovey, M.M. and Bak, A. Intracellular conductance of Aplysia neurons and squid axon as determined by a new technique. Intl. J. Neurosci., 2:35-48, 1971.
21. Carpenter, D.O., Breese, G., Schanberg, S. and Kopin, I. Serotonin and dopamine: Distribution and accumulation in Aplysia nervous and non-nervous tissues. Int. J. Neurosci., 2:49-56, 1971.
22. Hovey, M.M., Bak, A.F. and Carpenter, D.O. Low internal conductivity of Aplysia neuron somata. Science, 176:1329-1331, 1972.
23. Carpenter, D.O. Electrogenic sodium pump and high specific resistance in nerve cell bodies of the squid. Science, 179:1336-1338, 1973.
24. Carpenter, D.O. and Rudomin, P. The organization of primary afferent depolarization in the isolated spinal cord of the frog. J. Physiol. (Lond.), 229:471-493, 1973.
25. Shain, W., Green, L.A., Carpenter, D.O., Sytkowski, A.J. and Vogel, Z. Aplysia acetylcholine receptors: Blockage by and binding of α -bungarotoxin. Brain Res., 72:225-240, 1974.
26. Pierau, Fr.-K., Torrey, P. and Carpenter, D.O. Mammalian cold receptor afferents: Role of an electrogenic sodium pump in sensory transduction. Brain Res., 73:156-160, 1974.
27. Saavedra, J.M., Brownstein, M.J., Carpenter, D.O. and Axelrod, J. Octopamine: Presence in single neurons in Aplysia suggests neurotransmitter function. Science, 185:364-365, 1974.

**DAVID CARPENTER
EXHIBIT A**

28. Willis, J.A., Gaubatz, G.L. and Carpenter, D.O. The role of the electrogenic sodium pump in modulation of pacemaker discharge of Aplysia neurons. J. Cell. Physiol., 84:463-472, 1974.
29. Brownstein, M.J., Saavedra, J.M., Axelrod, J., Zeman, G.H. and Carpenter, D.O. Coexistence of several putative neurotransmitters in single identified neurons of Aplysia. Proc. Natl. Acad. Sci. (USA), 71:4662-4665, 1975.
30. Carpenter, D.O. and Gaubatz, G.L. Octopamine receptors on Aplysia neurons mediate hyperpolarization by increasing membrane conductance. Nature, 252:483-485, 1974.
31. Pierau, Fr.-K., Torrey, P. and Carpenter, D.O. Afferent nerve fiber activity responding to temperature changes of the scrotal skin of the rat. J. Neurobiol., 38:601-612, 1975.
32. Carpenter, D.O. and Gaubatz, G.L. H₁ and H₂ histamine receptors on Aplysia neurons. Nature, 254:343-344, 1975.
33. Carpenter, D.O., Hovey, M.M. and Bak, A.F. Resistivity of axoplasm. II. Internal resistivity of giant axons of squid and Myxicola. J. Gen. Physiol., 66:139-148, 1975.
34. Zeman, G.H. and Carpenter, D.O. Asymmetric distribution of aspartate in ganglia and single neurons of Aplysia. Comp. Biochem. Physiol., 52C:23-26, 1975.
35. Pierau, Fr.-K., Torrey, P. and Carpenter, D.O. Effect of ouabain and potassium-free solution on mammalian thermosensitive afferents in vitro. Pflugers Arch., 359:349-356, 1975.
36. Swann, J.W. and Carpenter, D.O. The organization of receptors for neurotransmitters on Aplysia neurons. Nature, 258:751-754, 1975.
37. Yarowsky, P.J. and Carpenter, D.O. Aspartate: distinct receptors on Aplysia neurons. Science, 192:806-809, 1976.
38. Foster, K.R., Bidinger, J.M. and Carpenter, D.O. The electrical resistivity of aqueous cytoplasm. Biophys. J., 16:991-1001, 1976.
39. Carpenter, D.O., Greene, L.A., Shain, W. and Vogel, Z. Effects of eserine and neostigmine on the interaction of α -bungarotoxin with Aplysia acetylcholine receptors. Mol. Pharmacol., 12:999-1006, 1976.
40. Saavedra, J.M., Ribas, J., Swann, J. and Carpenter, D.O. Phenylethanolamine: A new putative neurotransmitter in Aplysia. Science, 195:1004-1006, 1977.
41. Carpenter, D.O., Swann, J.W. and Yarowsky, P.J. Effect of curare on responses to different putative neurotransmitters in Aplysia neurons. J. Neurobiol., 8:119-132, 1977.
42. Yarowsky, P.J. and Carpenter, D.O. GABA mediated excitatory responses on Aplysia neurons. Life Sci., 20:1441-1448, 1977.
43. Willis, J.A., Myers, P.R. and Carpenter, D.O. An ionophoretic module which controls electroosmosis. J. Electrophysiol. Tech., 6:34-41, 1977.
44. Yarowsky, P.J. and Carpenter, D.O. Receptors for gamma-aminobutyric acid (GABA) on Aplysia neurons. Brain Res., 144:75-94, 1978.
45. Carpenter, D.O., Gaubatz, G., Willis, J.A. and Severance, R. Effects of irradiation of Aplysia pacemaker neurons with 20 MeV electrons. Rad. Res., 76:32-47, 1978.
46. Yarowsky, P.J. and Carpenter, D.O. A comparison of similar ionic responses to gamma-aminobutyric acid and acetylcholine. J. Neurophysiol., 41:531-541, 1978.
47. Blum, B., Aufer, C.R. and Carpenter, D.O. A head holder and stereotaxic device for the rattlesnake. Brain Res. Bull., 3:271-274, 1978.

**DAVID CARPENTER
EXHIBIT A**

48. Swann, J.W., Sinback, C.N. and Carpenter, D.O. Dopamine-induced muscle contractions and modulation of neuromuscular transmission in Aplysia. Brain Res., 157:167-172, 1978.
49. Swann, J.W., Sinback, C.N. and Carpenter, D.O. Evidence for identified dopamine motor neurons to the gill of Aplysia. Neurosci. Lett., 10:275-280, 1978.
50. Keabian, P.R., Keabian, J.W. and Carpenter, D.O. Regulation of cyclic AMP in heart and gill of Aplysia by the putative neurotransmitters, dopamine and serotonin. Life Sci., 24:1757-1764, 1979.
51. Carpenter, D.O. Interchangeable association of neurotransmitter receptors with several ionophores. Brain Res. Bull., 4:149-152, 1979.
52. Pellmar, T.C. and Carpenter, D.O. Voltage-dependent calcium current induced by serotonin. Nature, 277:483-484, 1979.
53. Ruben, P.C., Swann, J.W. and Carpenter, D.O. Neurotransmitter receptors on gill muscle fibers and the gill peripheral nerve plexus in Aplysia. Canad. J. Physiol. Pharmacol., 57:1088-1097, 1979.
54. Pellmar, T.C. and Carpenter, D.O. Serotonin induces a voltage-sensitive calcium current in neurons of Aplysia californica. J. Neurophysiol., 44:423-439, 1980.
55. Parver, L.M., Auker, C. and Carpenter, D.O. Choroidal blood flow as a heat dissipating mechanism in the macula. Am. J. Ophthalmol., 89:641-646, 1980.
56. Mell, L.D., Jr. and Carpenter, D.O. Fluorometric determination of octopamine in tissue homogenates by high-performance liquid chromatography. Neurochem. Res., 5:1089-1096, 1980.
57. Braitman, D.J., Auker, C.R. and Carpenter, D.O. Thyrotropin-releasing hormone has multiple actions in cortex. Brain Res., 194:244-248, 1980.
58. Meszler, R.M., Auker, C.R. and Carpenter, D.O. Fine structure and organization of the infrared receptor relay, the lateral descending nucleus of the trigeminal nerve in pit vipers. J. Comp. Neurol., 196:571-584, 1981.
59. Auker, C.R., Parver, L.M., Doyle, T. and Carpenter, D.O. Choroidal blood flow: I. Ocular tissue temperature as a measure of flow. Arch. Ophthalmol., 100:1323-1326, 1982.
60. Parver, L.M., Auker, C., Carpenter, D.O. and Doyle, T. Choroidal blood flow: II. Reflexive control in the monkey. Arch. Ophthalmol., 100:1327-1330, 1982.
61. Hori, N., Auker, C.R., Braitman, D.J. and Carpenter, D.O. Lateral olfactory tract transmitter: Glutamate, aspartate or neither? Cell. Mol. Neurobiol., 1:115-120, 1981.
62. Scappaticci, K.A., Dretchen, K.L., Carpenter, D.O. and Pellmar, T.C. Effects of furosemide on neural mechanisms in Aplysia. J. Neurobiol., 12:329-341, 1981.
63. Pellmar, T.C. and Carpenter, D.O. Cyclic AMP induces a voltage-dependent current in neurons of Aplysia californica. Neurosci. Lett., 22:151-157, 1981.
64. Parver, L., Auker, C. and Carpenter, D.O. Stabilization of macular temperature: The stabilizing effect of the choroidal circulation on the temperature environment of the macula. Retina, 2:117-120, 1982.
65. Green, R.W. and Carpenter, D.O. Biphasic responses to acetylcholine in mammalian reticulospinal neurons. Cell. Molec. Neurobiol., 1:401-405, 1981.
66. Hori, N., Auker, C.R., Braitman, D.J. and Carpenter, D.O. Pharmacologic sensitivity of amino acid responses and synaptic activation of in vitro prepyriform neurons. J. Neurophysiol., 48:1289-1301, 1982.

**DAVID CARPENTER
EXHIBIT A**

67. Slater, N.T. and Carpenter, D.O. Blockade of acetylcholine-induced inward currents in *Aplysia* neurons by strychnine and desipramine: effect of membrane potential. Cell. Molec. Neurobiol., 2:53-58, 1982.
68. Swann, J.W., Sinback, C.N., Pierson, M.G. and Carpenter, D.O. Dopamine produces muscle contractions and modulates motoneuron-induced contractions in *Aplysia* gill. Cell. Molec. Neurobiol., 2:291-308, 1982.
69. Swann, J.W., Sinback, C.N., Keabian, P.R. and Carpenter, D.O. Motoneurons which may utilize dopamine as their neurotransmitter. Cell. Molec. Neurobiol., 2:309-324, 1982.
70. Auker, C.R., Meszler, R.M. and Carpenter, D.O. Apparent discrepancy between single unit activity and ¹⁴C-deoxyglucose labelling in the optic tectum of the rattlesnake. J. Neurophysiol., 49:1504-1516, 1983.
71. Slater, N.T., Carpenter, D.O., Freedman, J.E. and Snyder, S.H. Vipoxin both activates and antagonizes three types of acetylcholine response in *Aplysia* neurons. Brain Res., 278:266-270, 1983.
72. French-Mullen, J.M.H., Hori, N., Nakanishi, H., Slater, N.T. and Carpenter, D.O. Asymmetric distribution of acetylcholine receptors and M channels on prepyriform neurons. Cell. Molec. Neurobiol., 3:163-182, 1983.
73. Carpenter, D.O., Briggs, D.B. and Strominger, N. Responses of neurons of canine area postrema to neurotransmitters and peptides. Cell. Molec. Neurobiol., 3:113-126, 1983.
74. Slater, N.T. and Carpenter, D.O. Blocking kinetics at excitatory acetylcholine responses on *Aplysia* neurons. Biophys. J., 45:24-25, 1984.
75. Chesnut, T.J. and Carpenter, D.O. Two-component desensitization of three types of responses to acetylcholine in *Aplysia*. Neurosci. Lett., 39:285-290, 1983.
76. Haas, H.L., Jeffreys, J.G.R., Slater, N.T. and Carpenter, D.O. Modulation of low calcium induced field bursts in the hippocampus by monoamines and cholinomimetics. Pflugers Arch., 400:28-33, 1984.
77. Parvar, L.M., Auker, C.R. and Carpenter, D.O. Choroidal blood flow. III. Reflexive control in human eyes. Arch. Ophthalmol., 101:1604-1606, 1983.
78. Slater, N.T., Haas, H.L. and Carpenter, D.O. Kinetics of acetylcholine-activated cation channel blockade by the calcium antagonist D-600 in *Aplysia* neurons. Cell. Molec. Neurobiol., 3:329-344, 1983.
79. McCreery, M.J. and Carpenter, D.O. Modulation of neuronal responses to L-glutamate in *Aplysia*. Cell. Molec. Neurobiol., 4:91-95, 1984.
80. Carpenter, D.O., Briggs, D.B. and Strominger, N. Peptide-induced emesis in dogs. Behav. Brain Res., 11:277-281, 1984.
81. French-Mullen, J.M.H., Hori, N. and Carpenter, D.O. N-methyl-D-aspartate and L-aspartate activate distinct receptors in prepyriform cortex. Cell. Molec. Neurobiol., 4:185-189, 1984.
82. Slater, N.T. and Carpenter, D.O. A study of the cholinolytic actions of strychnine using the technique of concentration jump relaxation analysis. Cell Molec Neurobiol 4:263-271, 1984.
83. Slater, N.T., Hall, A.F. and Carpenter, D.O. Kinetic properties of cholinergic desensitization in *Aplysia* neurons. Proc. Roy. Soc. Lond. B, 223:63-78, 1984.
84. Akaike, N., Hattori, K., Oomura, Y. and Carpenter, D.O. Bicuculline and picrotoxin block gamma-aminobutyric acid-gated Cl⁻ conductance by different mechanisms. Experientia, 41:70-71, 1985.

DAVID CARPENTER
EXHIBIT A

85. Slater, N.T., Carpenter, D.O., Freedman, J.E. and Synder, S.H. Dual effects of the snake venom polypeptide vipoxin on receptors for acetylcholine and biogenic amines in *Aplysia* neurons. Neurosci., 14:723-733, 1985.
86. Mizuno, Y., Oomura, Y., Hori, N. and Carpenter, D.O. Action of vasopressin on CA1 pyramidal neurons in rat hippocampal slices. Brain Res., 309:241-246, 1984.
87. Slater, N.T., Hall, A.F. and Carpenter, D.O. Trifluoperazine and calcium antagonists accelerate cholinergic desensitization in *Aplysia* neurons. Brain Res., 329:275-279, 1985.
88. ffrench-Mullen, J.M.H., Koller, K., Zaczek, R., Coyle, J.T., Hori, N. and Carpenter, D.O. N-acetylaspartylglutamate: Possible role as the neurotransmitter of the lateral olfactory tract. Proc. Nat. Acad. Sci., 82:3897-3900, 1985.
89. Greene, R.W. and Carpenter, D.O. Actions of neurotransmitters on pontine medial reticular formation neurons of the cat. J. Neurophysiol., 54:520-531, 1985.
90. Hori, N., ffrench-Mullen, J.M.H. and Carpenter, D.O. Kainic acid responses and toxicity show pronounced Ca^{2+} dependence. Brain Res., 358:380-384, 1985.
91. Gaillard, W.D. and Carpenter, D.O. Spectra of neurotransmitter receptors and ionic responses on cerebral A and B neurons in *Aplysia californica*. Brain Res., 373:303-310, 1986.
92. Gaillard, W.D. and Carpenter, D.O. On the transmitter at the A-to-B cell in *Aplysia californica*. Brain Res., 373:311-315, 1986.
93. ffrench-Mullen, J.M.H., Hori, N. and Carpenter, D.O. A comparison on the effects of quinolinate and N-methyl-aspartate on neurons in rat piriform cortex. Neurosci. Lett., 63:66-70, 1986.
94. ffrench-Mullen, J.M.H., Hori, N. and Carpenter, D.O. Receptors for the excitatory amino acids on neurons in rat pyriform cortex. J. Neurophysiol., 55:1283-1294, 1986.
95. Slater, N.T., David, J.A. and Carpenter, D.O. Relaxation studies on the interaction of hexamethonium with acetylcholine-receptor channels in *Aplysia* neurons. Cell. Molec. Neurobiol., 6:191-211, 1986.
96. Leung, M.K., S.-Rozsa, K., Hall, A., Kuruvilla, S., Stefano, G.B. and Carpenter, D.O. Enkephalin-like substance in *Aplysia* nervous tissue and actions of leu-enkephalin on single neurons. Life Sci., 38:1529-34, 1986.
97. Slater, N.T., Filbert, M. and Carpenter, D.O. Multiple interactions of anticholinesterases with *Aplysia* acetylcholine responses. Brain Res., 375:407-412, 1986.
98. Carpenter, D.O. and Briggs, D.B. Insulin excites neurons of the area postrema and causes emesis. Neurosci. Lett., 68:85-89, 1986.
99. Carpenter, D.O., Briggs, D.B., Knox, A.P. and Strominger, N.L. Radiation-induced emesis in the dog: Effects of lesions and drugs. Rad. Res., 108:307-316, 1986.
100. Briggs, D.B. and Carpenter, D.O. Excitation of neurons in the canine area postrema by prostaglandins. Cell. Molec. Neurobiol., 6:421-426, 1986.
101. Chesnut, T.J., Carpenter, D.O. and Strichartz, G.R. Three effects of venom from *conus striatus* on the delayed rectifier potassium current of molluscan neurons. Toxicon, 25:267-278, 1987.
102. Yakushiji, T., Tokutomi, N., Akaike, N. and Carpenter, D.O. Agonists of GABA responses, studied using internally perfused frog dorsal root ganglion neurons. Neuroscience 22:1123-1133, 1987.
103. Akaike, N., Yakushiji, T., Tokutomi, N. and Carpenter, D.C. Multiple mechanisms of antagonism of GABA responses. Cell. Molec. Neurobiol., 7:97-103, 1987.

**DAVID CARPENTER
EXHIBIT A**

104. Hori, N., Galeno, T. and Carpenter, D.O. Responses of pyriform cortex neurons to excitatory amino acids: Voltage dependence, conductance changes and effects of divalent cations. Cell. Molec. Neurobiol., 7:73-90, 1987.
105. Oyama, Y., King, W.M. and Carpenter, D.O. Edrophonium-induced membrane current in single neurons physically isolated from Aplysia californica. Brain Res., 438:95-100, 1988.
106. Jahan-Parwar, B., S.-Rozsa, K., Salanki, J., Evans, M.L. and Carpenter, D.O. In vivo labeling of serotonin containing neurons by 5,7-dihydroxytryptamine in Aplysia. Brain Res., 426:173-178, 1987.
107. King, W.M. and Carpenter, D.O. Distinct GABA and glutamate receptors may share a common channel in Aplysia neurons. Neurosci. Lett., 82:343-348, 1987.
108. Carpenter, D.O., Briggs, D.B., Knox, A.P. and Strominger, N. Excitation of area postrema neurons by transmitters, peptides and cyclic nucleotides. J. Neurophysiol., 59:358-369, 1988.
109. Carpenter, D.O., Hall, A.F. and Rahmann, H. Exogenous gangliosides induce direct voltage and conductance changes on isolated neurons. Cell. Molec. Neurobiol., 8:245-250, 1988.
110. Hori, N., Carpenter, D.O. and Katsuda, N. Effect of acetylcholine on the pyramidal cell in the rat piriform cortex in vitro. Neurosciences, 13:172-174, 1987 (in Japanese).
111. Hori, N. and Carpenter, D.O. Excitatory amino acid receptors in piriform cortex do not show receptor desensitization. Brain Res., 457:350-354, 1988.
112. Allen, C.N., Brady, R., Swann, J., Hori, N. and Carpenter, D.O. N-methyl-D-aspartate (NMDA) receptors are inactivated by trypsin. Brain Res., 458:147-150, 1988.
113. Oyama, Y., Akaike, N. and Carpenter, D.O. Strychnine decreases the voltage-dependent Ca^{2+} current of both Aplysia and frog ganglion neurons. Cell. Molec. Neurobiol., 8:307-314, 1988.
114. Oyama, Y., King, W.M., Allen, C.N., Hori, N. and Carpenter, D.O. Characterization of an inward current elicited by edrophonium in physically isolated and internally perfused Aplysia neurons. Brain Res., 463:124-132, 1988.
115. Hori, N., Akaike, N. and Carpenter, D.O. Piriform cortex brain slices: Techniques for isolation of synaptic inputs. J. Neurosci. Methods, 25:197-208, 1988.
116. Oyama, Y., Evans, M.L., Akaike, N. and Carpenter, D.O. Electrophysiological detection of acetylcholinesterase activity using concentration clamp on physically isolated Aplysia neurons. Neuroscience Res., 6:174-180, 1988.
117. Tsuda, Y., Oyama, Y., Carpenter, D.O. and Akaike, N. Effects of Ca^{2+} on the transient outward current of single isolated Helix central neurones. Brit J. Pharmacol., 95:526-530, 1988.
118. Oyama, Y., Hori, N., Evans, M.L., Allen, C.N. and Carpenter, D.O. Electrophysiological estimation of the actions of acetylcholinesterase inhibitors on acetylcholine receptor and cholinesterase in physically isolated Aplysia neurones. Brit. J. Pharmacol., 96:573-582, 1989.
119. King, W.M. and Carpenter, D.O. Voltage-clamp characterization of Cl^- conductance gated by GABA and L-glutamate in single neurons of Aplysia. J. Neurophysiol., 61:892-899, 1989.
120. Evans, M.L. and Carpenter, D.O. Desensitization kinetics of a chloride acetylcholine response in Aplysia. Brain Res., 495:309-318, 1989.
121. Salanki, J., Evans, M.L. and Carpenter, D.O. Desensitization kinetics of a K^+ acetylcholine response in Aplysia. Brain Res., 495:298-308, 1989.
122. Büsselberg, D., Evans, M.L., Rahmann, H. and Carpenter, D.O. Effects of exogenous ganglioside and cholesterol application on excitability of Aplysia neurons. Membrane Biochemistry, 8:19-26, 1989.

**DAVID CARPENTER
EXHIBIT A**

123. Carpenter, D. Neural mechanisms of emesis. Canad. J. Physiol. Pharmacol., 68:230-236, 1990.
124. Oyama, Y., Hori, N., Allen, C.N., and Carpenter, D.O. Influences of trypsin and collagenase on acetylcholine responses of physically-isolated single neurons of *Aplysia californica*. Cell. Molec. Neurobiol., 10:193-205, 1990.
125. Büsselberg, D., Evans, M.L., Rahmann, H., and Carpenter, D.O. Lead inhibits the voltage-activated calcium current of *Aplysia* neurons. Toxicol. Lett., 51:51-57, 1990.
126. Doi, N., Carpenter, D.O. and Hori, N. Differential effects of baclofen and GABA on rat piriform cortex pyramidal neurons *in vitro*. Cell. Molec. Neurobiol., 10: 559-564, 1991.
127. Büsselberg, D., Evans, M.L., Rahmann, H. and Carpenter, D.O. Zn^{2+} blocks the voltage activated calcium current of *Aplysia* neurons. Neurosci. Letts., 117:117-122, 1990.
128. Büsselberg, D., Carpenter, D.O., Sugita, M., Araki, S., Satake, M. and Rahmann, H. Effects of exogenous lipid application on excitability of *Aplysia* neurons. Biomed. Res., 11:77-86, 1990.
129. Evans, M.L., Kadan, M.J., Hartig, P.R. and Carpenter, D.O. Correlation of ^{125}I -LSD autoradiographic labelling with serotonin voltage clamp responses in *Aplysia* neurones. Synapse, 8:22-29, 1991.
130. S.-Rozsa, K., Stefano, G., Salanki, J. and Carpenter, D.O. Characterization of responses to enkephalins and FMRFamide on B neurons of the cerebral ganglion of *Aplysia*. Comp. Biochem. Physiol., 99C:403-412, 1991.
131. Büsselberg, D., Evans, M.L., Rahmann, H. and Carpenter, D.O. Lead and zinc block a voltage activated calcium channel of *Aplysia* neurons. J. Neurophysiol., 65:786-795, 1991.
132. Hori, N., Doi, N., Miyahara, S., Shinoda, Y. and Carpenter, D.O. Appearance of NMDA receptors triggered by anoxia independent of voltage *in vivo* and *in vitro*. Exp. Neurol., 112:304-311, 1991.
133. Büsselberg, D., Evans, M.L., Rahmann, H. and Carpenter, D.O. Effects of inorganic and triethyl lead and inorganic mercury on the voltage activated calcium channel of *Aplysia* neurons. NeuroToxicology, 12:733-744, 1991.
134. Evans, M.L., Büsselberg, D. and Carpenter, D.O. Pb^{2+} blocks calcium currents of cultured dorsal root ganglion cells. Neurosci. Letts., 129:103-106, 1991.
135. Kemenes, G., S.-Rozsa, K., Stefano, G. and Carpenter, D.O. Distinct receptors for leu- and met-enkephalin on the metacerebral giant cell of *Aplysia*. Cell. Molec. Neurobiol., 12:107-119, 1992.
136. Ayrapetyan, S.N. and Carpenter, D.O. Very low concentrations of acetylcholine and GABA modulate transmitter responses. NeuroReport 2:563-565, 1991.
137. Carpenter, D.O. and Hori, N. Neurotransmitter and peptide receptors on medial vestibular nucleus neurons. Ann. NY Acad. Sci., 656:668-686, 1992.
138. Hernadi, L., S.-Rozsa, K., Jahan-Parwar, B. and Carpenter, D.O. A topography and ultrastructural characterization of *in vivo* 5,7-dihydroxytryptamine-labelled serotonin-containing neurons in the central nervous system of *Aplysia californica*. Cell. Molec. Neurobiol., 12:317-326, 1992.
139. Carpenter, D.O., Fejtl, M., Ayrapetyan, S., Szarowski, D. and Turner, J.N. Dynamic changes in neuronal volume resulting from osmotic and sodium transport manipulations. Acta Biologica Hungarica, 43:39-48, 1992.
140. Ayrapetyan, S.N. and Carpenter, D.O. On the modulating effect of ultralow transmitter concentrations on the functional activity of the neuron membrane. J. Evol. Biochem. Physiol., 27:110-116, 1991.

**DAVID CARPENTER
EXHIBIT A**

141. Büsselberg, D., Michael, D., Evans, M.L., Carpenter, D.O. and Haas, H.L. Zinc (Zn^{2+}) blocks voltage gated calcium channels in cultured rat dorsal root ganglion cells. Brain Res., 593:77-81, 1992.
142. Matthews, M.R., Parsons, P.J. and Carpenter, D.O. Solubility of lead as lead (II) chloride in HEPES-Ringer and artificial seawater (Ca-ASW) solutions. NeuroToxicology, 14:283-290, 1993.
143. Hori, N., Büsselberg, D., Matthews, R., Parsons, P.J. and Carpenter, D.O. Lead blocks LTP by an action not at NMDA receptors. Exp. Neurol., 119: 192-197, 1993.
144. Büsselberg, D., Evans, M.L., Haas, H.L. and Carpenter, D.O. Blockade of mammalian and invertebrate calcium channels by lead. NeuroToxicology, 14:249-258, 1993.
145. Riepe, M., Hori, N., Ludolph, A.C., Carpenter, D.O., Spencer, P.S. and Allen, C.N. Inhibition of energy metabolism by 3-nitropropionic acid activates ATP-sensitive potassium channels. Brain Res., 586:61-66, 1992.
146. Hori, N., Hirotsu, I., Davis, P.J. and Carpenter, D.O. Long-term potentiation is lost in aged rats but preserved by calorie restriction. NeuroReport, 3:1085-1088, 1992.
147. Knox, A.P., Strominger, N.L., Battles, A.H. and Carpenter, D.O. Behavioral studies of emetic sensitivity in the ferret. Brain Res. Bull., 31:477-484, 1993.
148. Allen, C.N., Spencer, P.S. and Carpenter, D.O. β -N-methylamino-L-alanine in the presence of bicarbonate is an agonist at non-N-methyl-D-aspartate-type receptors. Neuroscience 54:567-574, 1993.
149. Elekes, K., Stefano, G.B. and Carpenter, D.O. Enkephalin-like immunoreactive neurons in the central nervous system of gastropods (*Helix pomatia*, *Lymnaea stagnalis*, *Aplysia californica*): A comparative immunocytochemical study. Cell Tiss. Res. 272:329-41, 1993.
150. Büsselberg, D., Platt, B., Haas, H.L. and Carpenter, D.O. Voltage gated calcium channel currents of rat dorsal root ganglion (DRG) cells are blocked by Al^{3+} . Brain Res. 622:163-168, 1993.
151. Strominger, N.L., Knox, A.P. and Carpenter, D.O. The connectivity of the area postrema in the ferret. Brain Res. Bull., 33:33-47, 1994.
152. Knox, A.P., Strominger, N.L., Battles, A.H. and Carpenter, D.O. The central connections of the vagus nerve in the ferret. Brain Res. Bull., 33:49-63, 1994.
153. Lin, Y. and Carpenter, D.O. Medial vestibular neurons are endogenous pacemakers whose discharge is modulated by neurotransmitters. Cell. Molec. Neurobiol., 13:601-613, 1993.
154. Kemenes, G., S.-Rózsa, K. and Carpenter, D.O. Cyclic-AMP-mediated excitatory responses to leucine enkephalin in *Aplysia* neurones. J. Exp. Biol. 181: 321-328, 1993.
155. Büsselberg, D., Platt, B., Michael, D., Carpenter, D.O. and Haas, H.L. Mammalian voltage-activated calcium channel currents are blocked by Pb^{2+} , Zn^{2+} and Al^{3+} . J. Neurophysiol., 71:1491-1497, 1994.
156. Hori, N. and Carpenter, D.O. Transient ischemia causes a reduction of Mg^{2+} blockade of NMDA receptors. Neurosci. Letts., 173:75-78, 1994.
157. Riepe, M.W., Hori, N., Ludolph, A.C. and Carpenter, D.O. Failure of neuronal ion exchange, not potentiated excitation, causes excitotoxicity after inhibition of oxidative phosphorylation. Neuroscience, 64:91-97, 1995.
158. Hori, N. and Carpenter, D.O. Functional and morphological changes induced by transient *in vivo* ischemia. Exp. Neurol., 129:279-289, 1994.
159. Lin, Y. and Carpenter, D.O. Direct excitatory opiate effects mediated by non-synaptic actions on rat medial vestibular neurons. Eur. J. Pharmacol., 262:99-106, 1994.

**DAVID CARPENTER
EXHIBIT A**

160. Carpenter, D.O. Epidemiological evidence for an association between exposure to 50 and 60 Hz magnetic fields and cancer. James Bay Publication Series, Hydro-Electric Development: Environmental Impacts - Paper No. 6, pp. 2-31, 1994.
161. Carpenter, D.O. Communicating with the public on issues of science and public health. Environ. Health Perspect. 103:127-130, 1995.
162. Fejtl, M., Gyori, J. and Carpenter, D.O. Hg²⁺ increases the open probability of carbachol-activated Cl⁻ channels in *Aplysia* neurons. NeuroReport, 5:2317-2320, 1994.
163. Carpenter, D.O. The public health significance of metal neurotoxicity. Cell. Molec. Neurobiol., 14:591-597, 1994.
164. Gyori, J., Fejtl, M. and Carpenter, D.O. Effect of HgCl₂ on acetylcholine, carbachol and glutamate currents of *Aplysia* neurons. Cell. Molec. Neurobiol., 14:653-664, 1994.
165. Fejtl, M., Gyori, J. and Carpenter, D.O. Mercuric (II) chloride modulates single channel properties of carbachol activated Cl⁻ channels in cultured neurons of *Aplysia californica*. Cell. Molec. Neurobiol., 14:665-674, 1994.
166. Carpenter, D.O., Matthews, M.R., Parsons, P.J. and Hori, N. Long-term potentiation in piriform cortex is blocked by lead. Cell. Molec. Neurobiol., 14:723-733, 1994.
167. Salanki, J., Gyori, J. and Carpenter, D.O. Action of lead on glutamate-activated chloride currents in *Helix Pomatia L.* neurons. Cell. Molec. Neurobiol., 14:755-768, 1994.
168. Carpenter, D.O. How hazardous wastes affect human health. Cent. Eur. J. Publ. Hlth. 2:6-9, 1994.
169. Oyama, Y., Carpenter, D.O., Ueno, S., Hayashi, H. and Tomiyoshi, F. Methylmercury induces Ca²⁺-dependent hyperpolarization of mouse thymocytes: A flow-cytometric study using fluorescent dyes. Eur. J. Pharmacol., 293:101-107, 1995.
170. Fejtl, M., Szarowski, D.H., Decker, D., Buttle, K., Carpenter, D.O. and Turner, J.N. Three-dimensional imaging and electrophysiology of live *Aplysia* neurons during volume perturbation: confocal light and high-voltage electron microscopy. JMSA 1(2):75-85, 1995.
171. Carpenter, D.O., Kemenes, G., Elekes, K., Leung, M., Stefano, G., S.-Rozsa, K. and Salanki, J. Opioid peptides in the nervous system of *Aplysia*: A combined biochemical immunocytochemical, and electrophysiological study. Cell. Molec. Neurobiol. 15:239-256, 1995.
172. Riepe, M. and Carpenter, D.O. Delayed increase of cell volume of single pyramidal cells in live hippocampal slices upon kainate application. Neurosci. Letts. 191:35-38, 1995.
173. Son, H. And Carpenter, D.O. Protein kinase C activation is necessary but not sufficient for induction of LTP at the synapse of mossy fiber-CA3 in the rat hippocampus. Neuroscience 72:1-13, 1996.
174. Iwase, T., Hori, N., Morioka, T. and Carpenter, D.O. Low power laser irradiation reduces ischemic damage in hippocampal slices *in vitro*. Lasers Surg. Med., 19:465-450, 1996.
175. Carpenter, D.O., King, W.M. and McCreery, M.J. The role of glutamate reuptake in regulation of glutamate responses in *Aplysia* neurons. Acta Biologica Hungaria 46:363-373, 1995.
176. Saghian, A.A., Ayrapetyan, S.N. and Carpenter, D.O. Low concentrations of ouabain stimulate Na/Ca exchange in neurons. Cell. Molec. Neurobiol., 16:489-498, 1996.
177. Platt, B., Carpenter, D.O., Büsselberg, D., Reymann, K.G. and Riedel, G. Aluminum impairs hippocampal long-term potentiation in rats *in vitro* and *in vivo*. Exp. Neurol., 134:73-86, 1995.
178. Rubakhin, S.S., Gyori, J., Carpenter, D.O. and Salanki, J. HgCl₂ potentiates GABA activated currents in *Lymnaea stagnalis L.* neurons. Acta Biologica Hungaria, 46:431-444, 1995.

DAVID CARPENTER
EXHIBIT A

179. Fejtl, M. and Carpenter, D.O. Neurite outgrowth is enhanced by conditioning factor(s) released from central ganglia of *Aplysia californica*. Neurosci. Letts., 199:33-36, 1995.
180. Riepe, M.W., Niemi, W.N., Megow, D., Ludolph, A.C. and Carpenter, D.O. Mitochondrial oxidation in rat hippocampus can be preconditioned by selective chemical inhibition of SDH. Exp. Neurol., 138:15-21, 1996.
181. Son, H. and Carpenter, D.O. Interactions among paired-pulse facilitation and post-tetanic and long-term potentiation in the mossy fiber-CA3 pathway in rat hippocampus. Synapse, 23:302-311, 1996.
182. Carpenter, D.O., Suk, W.A., Blaha, K. and Cikrt, M. Hazardous wastes in Eastern and Central Europe. Environ. Health Perspect., 104:244-248, 1996.
183. Son, H., Davis, P.J. and Carpenter, D.O. Time course and involvement of protein kinase C-mediated phosphorylation of F1/GAP-43 in area CA3 after the mossy fiber stimulation. Cell. Molec. Neurobiol., 17:171-194, 1997.
184. Dyatlov, V.A., Platoshin, A.V., Lawrence, D.A. and Carpenter, D.O. Mercury (Hg²⁺) enhances the depressant effect of kainate on Ca-inactivated potassium current in telencephalic cells derived from chick embryos. Toxicol. Appl. Pharmacol., 138:285-297, 1996.
185. Carpenter, D.O. and Conway, J.B. Optimizing professional education in public health. J. Public Health Management Practice, 2:66-72, 1996.
186. Carpenter, D.O. Great Lakes contaminants: A shift in human health outcomes. Health and Environment Digest, 10:17-19, 1996.
187. Boldyrev, A.A., Stvolinsky, S.L., Tyulina, O.V., Koshelev, V.B., Hori, N. and Carpenter, D.O. Biochemical and physiological evidence that carnosine is an endogenous neuroprotector against free radicals. Cell. Molec. Neurobiol., 17:259-271, 1997.
188. Szűcs, A., Angiello, C., Salánki, J. and Carpenter, D.O. Effects of inorganic mercury and methylmercury on the ionic currents of cultured rat hippocampal neurons. Cell. Molec. Neurobiol., 17:273-288, 1997.
189. Niemi, W.D., Slivinski, K., Audi, J., Rej, R. and Carpenter, D.O. Propylthiouracil treatment reduces long-term potentiation in area CA1 of neonatal rat hippocampus. Neurosci. Letts., 210:127-129, 1996.
190. Son, H., Madelian, V. and Carpenter, D.O. The translocation and involvement of protein kinase C in mossy fiber-CA3 long-term potentiation in hippocampus of the rat brain. Brain Res., 739:282-292, 1997.
191. Oyama, Y., Carpenter, D.O., Chikahisa, L. and Okazaki, E. Flow-cytometric estimation on glutamate- and kainate-induced increases in intracellular Ca²⁺ of brain neurons. Brain Research, 728:121-124, 1996.
192. Carpenter, D.O., Stoner, C.R.T. and Lawrence, D.A. Flow cytometric measurements of neuronal death triggered by PCBs. NeuroToxicology, 18:507-514, 1997.
193. Azatian, K.V., Ayrapetyan, S.N. and Carpenter, D.O. Metabotropic GABA receptors regulate acetylcholine responses on snail neurons. Gen. Pharmacol., 29:67-72, 1997.
194. Carpenter, D.O., Stoner, C.T., Lawrence, D.A., Niemi, W.D., Shain, W. and Seegal, R. Multiple mechanisms of PCB neurotoxicity. Proceedings of the 1996 Pacific Basin Conference on Hazardous Waste, Kuala Lumpur, Malaysia, CONF-9611157, pp. 404-918.
195. Carpenter, D.O. New Dimensions in our understanding of the human health effects of environmental pollutants. Proceedings of the 1996 Pacific Basin Conference on Hazardous Waste, Kuala Lumpur, Malaysia, CONF-9611157, pp. 37-53.

DAVID CARPENTER
EXHIBIT A

196. Carpenter, D.O. Possible effects of electromagnetic fields on the nervous system and development. Men. Retard. Dev. Dis. Res. Rev. 3:270-274, 1997.
197. Chiarenzelli, J., Scrudato, R., Bush, B., Carpenter, D. and Bushart, S. Do large-scale remedial and dredging events have the potential to release significant amounts of semi-volatile compounds to the atmosphere? Environ. Hlth. Perspect., 106:47-49, 1998.
198. Dyatlov, V.A., Dytlova O.M., Parsons, P.H., Lawrence, D.A. and Carpenter, D.O. Lipopolysaccharide and interleukin-6 enhance lead entry into cerebellar neurons: Application of a new and sensitive flow cytometric technique to measure intracellular lead and calcium concentrations. NeuroToxicology, 19:293-302, 1998.
199. Dyatlov, V.A., Platoshin, A.V., Lawrence, D.A. and Carpenter, D.O. Lead potentiates cytokine- and glutamate-mediated increases in permeability of the blood-brain barrier. NeuroToxicology, 19:283-292, 1998.
200. Niemi, W.D., Audi, J., Bush, B. and Carpenter, D.O. PCBs reduce long-term potentiation in the CA1 region of rat hippocampus. Exper. Neurol., 151:26-34, 1998.
201. Carpenter, D.O. Health effects of metals. Cent. Eur. J. Publ. Hlth., 6:160-163, 1998.
202. Carpenter, D.O., Bláha, K., Buekens, A., Cikrt, M., Damstra, T., Dellinger, B., Sarofim, A., Suk, W.A., Wykes, H. and Zejda, J. Remediation of hazardous wastes in Central and Eastern Europe: Technology and health effects. Cent. Eur. J. Publ. Hlth., 6:77-78, 1998.
203. Carpenter, D.O. Human health effects of environmental pollutants: New Insights. Environ. Monitor. Assess. J., 53:245-258, 1998.
204. Dyatlov, V.A., Makovetskaia, V.V., Leonhardt, R., Lawrence, D.A. and Carpenter, D.O. Vitamin E enhances Ca²⁺-mediated vulnerability of immature cerebellar granule cells to ischemia. Free Rad. Biol. Med., 25: 793-802, 1998.
205. Fitzgerald, E.F., Schell, L.M., Marshall, E.G., Carpenter, D.O., Suk, W.A. and Zejda, J.E. Environmental pollution and child health in Central and Eastern Europe. Environ. Health Persp., 106:307-311, 1998.
206. Carpenter, D.O., Arcaro, K.F., Bush, B., Niemi, W.D., Pang, S. and Vakharia, D.D. Human health and chemical mixtures: An overview. Environ. Health Perspect., 106: 1263-1270, 1998.
207. Carpenter, D.O., Cikrt, M. and Suk, W.A. Hazardous wastes in Eastern and Central Europe: Technology and health effects. Environ. Health Perspect., 107: 3-4, 1999.
208. Carpenter, D.O. Polychlorinated biphenyls and human health. Int. J. Occup. Med. Environ. Hlth. 11: 291-303, 1998.
209. Boldyrev, A.A., Johnson, P., Yanzhang, W., Tan, Y. and Carpenter, D.O. Carnosine and taurine protect rat cerebellar granular cells from free radical damage. Neurosci. Letts., 263: 169-172, 1999.
210. Boldyrev, A.A., Carpenter, D.O., Huentelman, M.J., Peters, C.M. and Johnson, P. Sources of reactive oxygen species production in excitotoxin-stimulated neurons. Biophys. Biochem. Res. Commun., 256: 320-324, 1999.
211. Ayrapetyan, S.N., Ayrapetyan, G. and Carpenter, D.O. The electrogenic sodium pump activity in *Aplysia* neurons is not potential dependent. Acta Biologica Hungarica, 50: 27-34, 1999.
212. Boldyrev, A., Song, R., Lawrence, D. and Carpenter, D.O. Carnosine protects against excitotoxic cell death independently of effects on reactive oxygen species. Neuroscience, 94: 571-577, 1999.
213. Boldyrev, A., Song, R., Dyatlov, V.A., Lawrence, D.A. and Carpenter, D.O. Neuronal cell death and reactive oxygen species. Cell. Molec. Neurobiol., 20:433-450, 2000.

DAVID CARPENTER
EXHIBIT A

214. Gyori, J., Platoshyn, O., Carpenter, D.O. and Salanki, J. Effect of inorganic- and organic tin compounds on ACh- and voltage-activated Na currents. Cell. Molec. Neurobiol. 20:591-604, 2000.
215. Hussain, R.J., Gyori, J., DeCaprio, A.P. and Carpenter, D.O. *In vivo* and *in vitro* exposure to PCB 153 reduces long-term potentiation. Environ. Hlth. Perspect. 108 :827-831, 2000.
216. Negoita, S., Swamp, L., Kelley, B. and Carpenter, D.O. Chronic diseases surveillance of St. Regis Mohawk health service patients. J. Public Health Management Practice, 7:84-91, 2001.
217. Hussain, R.J., Parsons, P.J., Carpenter, D.O. Effects of lead on long-term potentiation in hippocampal CA3 vary with age. Dev. Brain Res. 121: 243-252, 2000.
218. Tanji, M., Katz, B.H., Spink, B.C. and Carpenter, D.O. Growth inhibition of MCF-7 cells by estrogen is dependent upon a serum factor. Anticancer Res. 20: 2779-2784, 2000.
219. Tanji, M. and Carpenter, D.O. A steroid-binding protein mediates estrogen-dependent inhibition of growth of MCF-7 breast cancer cells. Anticancer Res. 20:2785-2790, 2000.
220. Gyori, J., Hussain, R., Carpenter, D.O. Long-term potentiation in CA1 region of rat brain slices is blocked by PCB 153. Cent. Europ. J. Publ. Hlth., 8: 21-22, 2000.
221. Carpenter, D.O. Human health effects of polychlorinated biphenyls. Cent. Eur. J. Public Health, 8: 23-24, 2000.
- 221a. Sukdolova, V., Negoita, S., Hubicki, L., DeCaprio, A., and Carpenter, D.O. The assessment of risk to acquired hypothyroidism from exposure to PCBs: a study among Akwesasne Mohawk women. Cent. Eur. J. Public Health, 8: 167-168, 2000.
222. Carpenter, D.O., Chew, F.T., Damstra, T., Lam, L.H., Landrigan, P.J., Makalinao, I., Peralta, G.L. and Suk, W.A. Environmental threats to the health of children: The Asian perspective. Environ. Hlth. Perspect. 108: 989-992, 2000.
223. Boldyrev, A.A., Carpenter, D.O. and Johnson, P. Natural mechanisms of protection of neurons against oxidative stress. Recent Res. Devel. Comparative Biochem. & Physiol. 1: 91-103, 2000.
224. Strominger, N.L., Hori, N., Carpenter, D.O., Tan, Y. and Folger W.H. Effects of acetylcholine and GABA on neurons in the area postrema of *Suncus murinus* brainstem slices. Neurosci. Letts. 309: 77-80, 2001.
225. Strominger, N.L., Brady, R., Gullikson, G. and Carpenter, D.O. Imiquimod-elicited emesis is mediated by the area postrema, but not by direct neuronal activation. Brain Res. Bull. 55: 445-451, 2001.
226. Hori, N., Tan, Y., Strominger, N.L. and Carpenter, D.O. Intracellular activity of rat spinal cord motoneurons in slices. J. Neurosci. Meth. 112: 185-191, 2001.
227. Sukocheva, O.A., Abramov, A.Y., Levitskaya, J.O., Gagelgans, A.I. and Carpenter, D.O. Modulation of intracellular Ca concentration by vitamin B12 in rat thymocytes. Blood Cells. Mol. Dis. 27: 812-824, 2001.
228. Gilbertson, M., Carpenter, D. and Upshur, R. Methodology for assessing community health in Areas of Concern: Measuring the adverse effects on human health. Environ. Health Perspect. 109 (Suppl 6): 811-812, 2001.
229. Carpenter, D.O., Shen, Y., Nguyen, T., Le, L. and Lininger, L.L. Incidence of endocrine disease among residents of New York Areas of Concern. Environ. Health Perspect. 109: (Suppl 6) 845-851, 2001.
230. Suk, W.A., Carpenter, D.O., Cirk, M. and Smerhovsky, Z. Metals in Eastern and Central Europe: Health effects, sources of contamination and methods of remediation. Internat. J. Occup. Med. Environ. Health 14, 151-156, 2001.

DAVID CARPENTER
EXHIBIT A

231. Carpenter, D.O. Effects of metals on the nervous system of humans and animals. Internat. J Occup. Med. Environ. Health 14: 209-218, 2001.
232. Carpenter, D.O., Arcaro, K. and Spink, D.C. Understanding the human health effects of chemical mixtures. Environ. Health Perspect. 110 (Suppl 1), 25-42, 2002.
233. Carpenter, D.O., Nguyen, T., Le, L., Kudyakov, R. and Lininger, L. Human disease in relation to residence near hazardous waste sites. Proceedings of The 10th Pacific Basin Conference on Hazardous Waste, Okayama, Japan, December 5-7, 2001.
234. Carpenter, D.O., Tarbell, A., Fitzgerald, E., Kadlec, M.J., O'Hehir, D.O. and Bush, B. University-community partnership for the study of environmental contamination at Akwesasne. In: Biomarkers of Environmentally Associated Disease, S.H. Wilson and W.A. Suk, editors, CRC Press/Lewis Publishers, 507-523, 2002.
235. Carpenter, D.O., Hussain, R.J., Berger, D.F., Lombardo, J.P., Park, H-Y. Electrophysiological and behavioral effects of perinatal and acute exposure of rats to lead and polychlorinated biphenyls. Environ. Health Perspect. 110: 377-386, 2002.
236. Hori, N., Tan, Y. King, M., Strominger, N.L. and Carpenter, D.O. Differential actions and excitotoxicity of glutamate agonists on motoneurons in adult mouse cervical spinal cord slices. Brain Res. 958: 434-438, 2002.
237. Laemle, L.K., Hori, N., Strominger, N.L., Tan, Y. and Carpenter, D.O. Physiological and anatomical properties of the suprachiasmatic nucleus of an anophthalmic mouse. Brain Res. 953: 73-81, 2002.
238. Hori, N., Tan, Y., Strominger, N.L. and Carpenter, D.O. Rat motoneuron cell death in development correlates with loss of N-methyl-D-aspartate receptors. Neurosci. Letts. 330:131-134, 2002.
239. Carpenter, D.O., Morris, D.L. and Legator, M. Initial attempts to profile health effects with types of exposure in Anniston, Alabama. FEB, 12: 191-195, 2003.
240. Carpenter, D.O., Nguyen, T., Le, L., Baibergenova, A. and Kudyakov, R. Profile of health effects related to proximity to PCB-contaminated hazardous waste sites in New York. FEB, 12: 173-180, 2003.
241. Hori, N., Carp, J.S., Carpenter, D.O. and Akaike, N. Corticospinal transmission to motoneurons in cervical spinal slices from adult rats. Life Sci. 72: 389-396, 2002.
242. Carpenter, D.O. and Hussain, R.J. Cell-to-cell communication of neurons is impaired by metals. Mat.-wiss. U. Werkstofftech. 34: 1-8, 2003.
243. Tan, Y., Hori, N. and Carpenter, D.O. The mechanism of presynaptic long-lasting-depression mediated by group 1 metabotropic glutamate receptors. Cell. Molec. Neurobiol. 23: 187-203, 2003.
244. Baibergenova, A., Kudyakov, R., Zdeb, M., and Carpenter, D.O. Low birth weight and residential proximity to PCB-contaminated waste sites. Environ. Health Perspect. 111: 1352-1357, 2003.
245. Nishizaki, Y., Oyama, Y., Sakai, Y., Hiram, S., Tomita, K., Nakao, H., Umebayashi, C., Ishida, S., Okano, Y. and Carpenter, D.O. PbCl₂-induced hyperpolarization of rat thymocytes: Involvement of charybdotoxin-sensitive K⁺ channels. Environ. Toxicol. 18(5): 321-326, 2003.
246. Hussain, R.J. and Carpenter, D.O. The effects of protein kinase C activity on synaptic transmission in two areas of rat hippocampus. Brain Res. 990: 28-37, 2003.
247. Suk, W.A., Ruchirawat, K., Balakrishnan, K., Berger, M., Carpenter, D., Damstra, T., Pronczuk de Garbino, J., Koh, D., Landrigan, P.J., Makalinalao, I., Sly, P.D., Xu, Y. and Zheng, B.S. Environmental threats to children's health in Southeast Asia and the Western Pacific. Environ. Health Perspect. 111: 1340, 2003.

**DAVID CARPENTER
EXHIBIT A**

248. Carpenter, D.O. The need for global environmental health policy. New Solutions, 13(1): 53-59, 2003.
249. Tan, Y., Li, D., Song, R., Lawrence, D. and Carpenter, D.O. Ortho-substituted PCBs kill thymocytes. Toxicol. Sci., 76: 328-337, 2003.
250. Boldyrev, A., Bulygina, E., Carpenter, D.O. and Schoner, W. Glutamate receptors communicate with Na⁺/K⁺-ATPase in rat cerebellum granule cells: Demonstration of differences in the action of several metabotropic and ionotropic glutamate agonists on intracellular reactive oxygen species and the sodium pump. J. Molec. Neurosci., 21:213-222, 2003.
251. Hites, R.A., Foran, J.A., Carpenter, D.O., Hamilton, M.C., Knuth, B.A. and Schwager, S.J. Global assessment of organic contaminants in farmed salmon. Science 303: 226-229, 2004.
252. Sandal, S., Yilmaz, B., Chen, C-H and Carpenter, D.O. Comparative effects of technical toxaphene, 2,5-dichloro-3-biphenylol and octabromodiphenylether on cell viability, [Ca²⁺]_i levels and membrane fluidity in mouse thymocytes. Toxicol. Letts., 151: 417-428, 2004.
253. Tan, Y., Chen, C-H., Lawrence, D. and Carpenter, D.O. Ortho-substituted PCBs kill cells by altering membrane structure. Toxicol. Sci., 80: 54-59, 2004.
254. Tan, Y., Song, R., Lawrence, D. and Carpenter, D.O. Ortho-substituted but not coplanar PCBs rapidly kill cerebellular granule cells. Toxicol. Sci., 79: 147-156, 2004.
255. Ozcan, M., Yilmaz, B., King, W.M. and Carpenter, D.O. Hippocampal long-term potentiation (LTP) is reduced by a coplanar PCB congener. NeuroToxicology, 25: 981-988, 2004.
256. Ssempebwa, J.C., Carpenter, D.O., Yilmaz, B., DeCaprio, A.P., O=Hehir, D.J. and Arcaro, K.F. Waste crankcase oil: an environmental contaminant with potential to modulate estrogenic responses. J. Toxicol. Environ. Hlth, Part A, 67: 1081-1094, 2004.
257. Foran, J.A., Hites, R.A., Carpenter, D.O., Hamilton, M.C., Mathews-Amos, A. and Schwager, S.J. A survey of metals in tissues of farmed Atlantic and wild Pacific salmon. Environ. Toxicol. Chem., 23: 2108-2110, 2004.
258. Oenga, G.N., Spink, D.C. and Carpenter, D.O. TCDD and PCBs inhibit breast cancer cell proliferation in vitro. Toxicol. In Vitro, 18: 811-819, 2004.
259. Hussain, R.J. and Carpenter, D.O. A comparison of the roles of protein kinase C in long-term potentiation in rat hippocampal areas CA1 and CA3. Cell. Molec. Neurobiol., 25: 649-661, 2005.
260. Hites, R.A., Foran, J.A., Schwager, S.J., Knuth, B.A., Hamilton, M.C. and Carpenter, D.O. Global assessment of polybrominated diphenyl ethers in farmed and wild salmon. Organohalogen Compounds, 66: 3826-3829, 2004.
261. Kudyakov, R., Baibergenova, A., Zdeb, M. and Carpenter, D.O. Respiratory disease in relation to patient residence near to hazardous waste sites. Environ. Toxicol. Pharmacol., 18: 249-257, 2004.
262. Gilbertson, M. and Carpenter, D.O. An ecosystem approach to the health effects of mercury in the Great Lakes basin ecosystem. Environ. Res. 95: 240-246, 2004.
263. Hites, R.A., Foran, J.A., Schwager, S.J., Knuth, B.A., Hamilton, M.C. and Carpenter, D.O. Global assessment of polybrominated diphenyl ethers in farmed and wild salmon. Environ. Sci. Technol., 38: 4945-4949, 2004.
264. DeCaprio, A.P., Johnson, G.W., Tarbell, A.M., Carpenter, D.O. Chiarenzelli, J.R., Morse, G.S., Santiago-Rivera, A.L., Schymura, M.J., and the Akwesasne Task Force on the Environment. PCB exposure assessment by multivariate statistical analysis of serum congener profiles in an adult Native American population. Environ. Res., 98: 284-302, 2005.

**DAVID CARPENTER
EXHIBIT A**

265. Boldyrev, A.A., Kazey, V.I., Leinsoo, T.A., Mashkina, A.P., Tyulina O.V., Tuneva, J.O., Chittur, S. and Carpenter, D.O. Rodent lymphocytes express functionally active glutamate receptors. Biochem. Biophys. Res. Comm., 324: 133-139, 2004.
266. Boldyrev, A.A., Koudinov, A., Berezov, T. and Carpenter, D.O. Amyloid- β induced cell death is independent of free radicals. J. Alzheimer's Dis., 6: 633-638, 2004.
267. Neagu, B., Strominger, N.L. and Carpenter, D.O. Use of bipolar parallel electrodes for well-controlled microstimulation in a mouse hippocampal brain slice. J. Neurosci. Meth., 144: 153-163, 2005.
268. Suk, W.A., Avakian, M.D., Carpenter, D., Groopman, J.D., Scammell, M. and Wild, C.P. Human exposure monitoring and evaluation in the Arctic: The importance of understanding exposures to the development of public health policy. Environ. Health Perspect. 112: 113-120, 2004.
269. Neagu, B., Neagu, E.R., Strominger, N.L. and Carpenter, D.O. A new fast electro-physiological response measured extracellularly in a mouse hippocampal brain slice. Neurosci. Letts., 381: 179-184, 2005.
270. Sergeev, A.V. and Carpenter, D.O. Hospitalization rates for coronary heart disease in relation to residence near areas contaminated with POPs and other pollutants. Environ. Health Perspect., 113: 756-761, 2005.
271. Foran, J.A., Carpenter, D.O., Hamilton, M.C., Knuth, B.A. and Schwager, S.J. Risk-based consumption advice for farmed Atlantic and wild Pacific salmon contaminated with dioxins and dioxin-like compounds. Environ. Health Perspect. 113: 552-556, 2005.
272. Shaw, S.D., Bourakovsky, A., Brenner, D., Carpenter, D.O., Tao, L., Kannan, K. and Hong, C-S. Polybrominated diphenyl ethers (PBDEs) in farmed salmon from Maine and Eastern Canada. In: Proceedings of 25th International Symposium on Halogenated Environmental Organic Pollutants and POPs (DIOXIN 2005), August 21-26, 2005, Toronto, Canada.
273. Carpenter, D.O., DeCaprio, A.P., O=Hehir, D., Akhtar, F., Johnson, G., Scrudato, R.J., Apatiki, L., Kava, J., Gologergen, J., Miller, P.K. and Eckstein, L. Polychlorinated biphenyls in serum of the Siberian Yupik people from St. Lawrence Island, Alaska. Int. J. Circumpolar Health, 64(4): 322-335, 2005.
274. Foran, J.A., Good, D.H., Carpenter, D.O., Hamilton, M.C., Knuth, B.A. and Schwager, S.J. Quantitative analysis of the benefits and risks of consuming farmed and wild salmon. J. Nutr 135: 2639-2643, 2005.
275. Huang, X., Hites, R.A., Foran, J.A., Hamilton, C., Knuth, B.A., Schwager, S.J. and Carpenter, D.O. Consumption advisories for salmon based on risk of cancer and non-cancer health effects. Environ. Res., 101: 263-274, 2006.
276. Shcherbatykh, I., Huang, X., Lessner, L. and Carpenter, D.O. Hazardous waste sites and stroke in New York State. Environ. Health, 4:18, 2005.
277. Hamilton, M.C., Hites, R.A., Schwager, S.J., Foran, J.A., Knuth, B.A. and Carpenter, D.O. Lipid composition and contaminants in farmed and wild salmon. Environ. Sci. Tech., 39: 8622-8629, 2005.
278. Yilmaz, B., Sandal, S., Chen, C-H. and Carpenter, D.O. Effects of PCB 52 and PCB 77 on cell viability, $[Ca^{2+}]_i$ levels and membrane fluidity in mouse thymocytes. Toxicology, 217: 184-193, 2006.
279. Tan, Y., Hori, N., and Carpenter, D.O. Electrophysiological effects of three groups of glutamate metabotropic receptors in rat piriform cortex. Cell. Molec. Neurobiol., 26: 915-924, 2006.
280. Boldyrev, A.A., Carpenter, D.O. and Johnson, P.A., Emerging evidence for a similar role of glutamate receptors in the nervous and immune systems. J. Neurochem., 95: 913-918, 2005.

**DAVID CARPENTER
EXHIBIT A**

281. Sandal, S., Yilmaz, B., Godekmerdan, A., Kelestimur, H. and Carpenter, D.O. Effects of PCBs 52 and 77 on Th1/Th2 balance in mouse thymocyte cell cultures. Immunopharmacol. Immunotoxicol. 27: 601-613, 2005.
282. Carpenter, D.O. Environmental contaminants and learning and memory. International Congress Series, 1287: 185-189, 2006.
283. Carpenter, D.O. Polychlorinated biphenyls (PCBs): Routes of exposure and effects on human health. Rev. Environ. Health, 21: 1-23, 2006.
284. Huang, X., Lessner, L. and Carpenter, D.O. Exposure to persistent organic pollutants and hypertensive disease. Environ. Res., 102: 101-106, 2006.
285. Carpenter, D.O., El-Qaderi, S., Fayzieva, D., Gilani, A., Hambartsumyan, A., Herz, K., Isobaev, M., Kasymov, O., Kudyakov, R., Majitova, Z., Mamadov, E., Nemer, L., Revich, B., Stege, P., Suk, W., Upshur, R., Yilmaz, B. and Zaineh K. Children's environmental health in Central Asia and the Middle East. Int. J. Occup. Environ. Health, 12: 362-368, 2006.
286. King, W.M., Sarup, V., Sauve, Y., Moreland, C.M., Carpenter, D.O. and Sharma, S.C. Expansion of visual receptive fields in experimental glaucoma. Visual Neurosci. 23: 137-142, 2006.
287. Tuneva, J., Chittur, S., Boldyrev, A.A., Birman, I. and Carpenter, D.O. Cerebellar granule cell death induced by aluminum. Neurotox. Res., 9: 297-304, 2006.
288. Trasande, L., Boscarino, J., Graber, N., Falk, R., Schechter, C., Dunkel, G., Geslani, J., Moline, J., Kaplan-Liss, E., Miller, R.K., Korfmacher, K., Carpenter, D., Balk, S.J., Laraque, D., Frumkin, H. and Landrigan, P.J. The environment in pediatric practice: A study of New York pediatricians' attitudes, beliefs, and practices towards children's environmental health. J. Urban Health, 2006, DOI: 10.1007/s11524-006-9071-4.
289. Surdu, S., Montoya, L.D., Tarbell, A. and Carpenter, D.O. Childhood asthma and indoor allergens in Native Americans in New York. Environ. Health: A Global Access Science Source, 5:22, 2006. DOI: 10.1186/1476-069X-5-22.
290. Ozcan M., Yilmaz, B. and Carpenter, D.O. Effects of melatonin on synaptic transmission and long term potentiation in two areas of mouse hippocampus. Brain Res., 1111: 90-94, 2006.
291. Shaw, S.D., Brenner, D., Berger, M.L., Pulser, E.L., Carpenter, D.O., Hong, C-W and Kannan K. PCBs, dioxin-like PCBs, dioxins, and organochlorine pesticides in farmed salmon (*Salmo salar*) from Maine and Eastern Canada. Environ. Sci. Technol. 40: 5347-5354, 2006.
292. Yilmaz, B., Ssempebwa J., Mackerer, C.R., Arcaro, K.F. and Carpenter, D.O. Effects of polycyclic aromatic hydrocarbon-containing oil mixtures on generation of reactive oxygen species and cell viability in MCF-7 breast cancer cells. J. Toxicol. Environ. Health, Part A: 70: 1-8, 2007.
293. Kouznetsova, M., Huang, X., Ma, J., Lessner, L. and Carpenter, D.O. Increased rate of hospitalization for diabetes and residential proximity of hazardous waste sites. Environ. Health Perspect., 115:75-79, 2007.
294. Yilmaz, Y., Seyran, A.D., Sandal, S., Aydin, M., Colakoglu, N., Kocer, M. and Carpenter, D.O. Modulatory effects of Aroclors 1221 and 1254 on bone turnover and vertebral histology in intact and ovariectomized rats. Toxicology Letts., 166: 276-294, 2006.
295. Shcherbatykh, I. and Carpenter, D.O. The role of metals in the etiology of Alzheimer's disease. J. Alzheimer's Dis., 11: 191-205, 2007.
296. Surdu S, Neamtii I, Gurzau E, Kasler I and Carpenter D. Blood lead levels and hand lead contamination in children ages 4-6 in Copsa Mica, Romania. In: *Environmental Health in Central and Eastern Europe*. KC Donnelly and LH Cizmas, Eds. Springer Netherlands. pp. 123-134, 2007.

**DAVID CARPENTER
EXHIBIT A**

297. Carpenter D.O. The importance of the Great Lakes Water Quality Agreement. J Public Health Policy 28: 216-220, 2007.
298. Codru N, Schymura MJ, Negoita S, the Akwesasne Task Force on the Environment, Rej R and Carpenter DO. Diabetes in relation to serum levels of polychlorinated biphenyls (PCBs) and chlorinated pesticides in adult Native Americans. Environ Health Perspect. 115: 1442-1447, 2007.
299. Carpenter DO. Biomarcadores de efectos neuroconductuales. Acta Toxicol Argent 14 (Suplemento): 11-12, 2006.
300. Hennig B, Ormsbee L, Bachas L, Silverstone A, Milner J, Carpenter D, Thompson C and Suk WA . Introductory comments: nutrition, environmental toxins and implications in prevention and intervention of human diseases. J Nutrit Biochem 189: 161-163, 2007.
301. Arnold R, Armour MA, Barich J, Cebrian M, Cifuentes L, Kirk D, Koh D, Lewis ND, Ling B, Makalinao I, Maiden T, Paz-y-Mino C, Peralta G, Singh K, Sly P, Suk W, Woodward A, Zheng B and Carpenter DO. Threats to human health and environmental sustainability in the Pacific Basin: The 11th International Conference of the Pacific Basin Consortium. Environ Health Perspect. 115: 1770-1775, 2007.
302. Parrish RR, Horstwood M, Arnason JG, Chenery S, Brewer T, Lloyd NS and Carpenter DO (2008) Depleted uranium contamination by inhalation exposure and its detection after approximately 25 years: Implications for health assessment. Sci Total Environ 390: 58-68.
303. Goncharov A, Haase RF, Santiago-Rivera A, Morse G, Akwesasne Task Force on the Environment, McCaffrey RJ, Rej R and Carpenter DO. (2008) High serum PCBs are associated with elevation of serum lipids and cardiovascular disease in a Native American population. Environ Res. 106: 226-239.
304. Ma J, Kouznetsova M, Lessner L and Carpenter DO. Asthma and infectious respiratory disease in children – correlation to residence near hazardous waste sites. Paediatr Respir Rev 8: 292-298, 2007.
305. Schell LM, Gallo MV, Denham M, Ravenscroft J, DeCaprio AP and Carpenter DO (2008) Relationship of thyroid hormone levels of polychlorinated biphenyls, lead, p,p'-DDE and other toxicants in Akwesasne Mohawk youth. Environ Health Perspect. 116: 806-813.
306. Ssempebwa J and Carpenter DO (2009) The generation, use and disposal of waste crankcase oil in developing countries: A case for Kampala District, Uganda. J Hazard Materials 161: 835-841.
307. Carpenter DO (2008) Environmental contaminants as risk factors for developing diabetes. Rev Environ Health 23: 59-74.
308. Shaw SD, Berger ML, Brenner D, Carpenter DO, Lao L, Hong CS and Kannan K (2008) Polybrominated diphenyl ethers (PBDEs) in farmed and wild salmon marketed in the Northeastern United States. Chemosphere 71: 1422-1431.
309. Sandel S, Yilmaz B and Carpenter DO (2008) Genotoxic effects of PCB 52 and PCB 77 on cultured human peripheral lymphocytes. Mutation Res. 654: 88-92.
310. Carpenter DO and Sage C (2008) Setting prudent public health policy for electromagnetic field exposures. Rev Environ Health 23: 91-117.
311. Neagu B, Strominger NL and Carpenter DO (2008) Contribution of NMDA receptor-mediated component to the EPSP in mouse Schaffer collateral synapses under single pulse stimulation protocol. Brain Res. 1240: 54-61.
312. Holdren J, Tao S and Carpenter DO (2008) Environment and health in the 21st Century: Challenges and solutions. Ann NY Acad Sci. 1140:1-21.

**DAVID CARPENTER
EXHIBIT A**

313. Carpenter DO, Ma J and Lessner L (2008) Asthma and infectious respiratory disease in relation to residence near hazardous waste sites. *Ann NY Acad Sci.* 1140: 201-208.
314. Sandal S, Tuneva J, Yilmaz B and Carpenter DO (2009) Effects of cholesterol and docosahexaenoic acid on cell viability and $(Ca^{2+})_i$ levels in acutely isolated mouse thymocytes. *Cell Biochem Funct* 27: 155-161.
315. Steele RE, de Leeuw, E and Carpenter DO (2009) A novel and effective treatment modality for medically unexplained symptoms. *J Pain Management* 1: 402-412
316. Sage C and Carpenter DO (2009) Public health implications of wireless technologies. *Pathophysiology* 16: 233-246.
317. Sly PD, Eskenazi B, Pronczuk J, Sram R, Diaz-Barriga F, Machin DG, Carpenter DO, Surdu S and Meslin EM (2009) Ethical issues in measuring biomarkers in children's environmental health. *Environ Health Perspect.* 117: 1185-1190.
318. Goncharov A, Rej R, Negoita S, Schymura M, Santiago-Rivera A, Morse G, Akwesasne Task Force on the Environment and Carpenter DO (2009) Lower serum testosterone associated with elevated polychlorinated biphenyl concentrations in Native American men. *Environ Health Perspect.* 117:1454-1460.
319. Tuneva JO, Karpova LV, Shittur SV, Carpenter DO, Johnson P and Boldyrev AA (2009) Amyloid- β and aluminum ions enhance neuronal damage mediated by NMDA-activated glutamate receptors. *Biochemistry (Moscow) Supplement Series A: Membrane and Cell Biology* 4: 466-471.
320. Carpenter DO and Nevin R (2009) Environmental causes of violence. *Physiol Behavior* 99: 260-268.
321. Goncharov A, Bloom MS, Pavuk M, Carpenter DO for the Anniston Environmental Health Research Consortium. (2009) Exposure to PCBs and hypertension in the Anniston Community Health Survey. *Organohal Comp* 71: 0-136.
322. Sergeev AV and Carpenter DO (2010) Residential proximity to environmental sources of persistent organic pollutants and first-time hospitalizations for myocardial infarction with comorbid diabetes mellitus: A 12-year population-based study. *Int J Occup Med Environ Health* 23: 5-13.
323. Carpenter DO (2010) Electromagnetic fields and cancer: The cost of doing nothing. *Rev Environ Health* 25: 75-80.
324. Sergeev AV and Carpenter DO (2010) Exposure to persistent organic pollutants increases hospitalization rates for myocardial infarction with comorbid hypertension. *Primary Prevention Insights.* 2: 1-9.
325. Hori N, Kadota MT, Watanabe M, Ito Y, Akaike N and Carpenter DO (2010) Neurotoxic effects of methamphetamine on rat hippocampus pyramidal neurons. *Cell Mol Neurobiol.*30: 849-856.
326. Hardell, S, Tilander H, Welfinger-Smith G and Carpenter DO (2010) Levels of polychlorinated biphenyls (PCBs) and three organochlorine pesticides in fishes from the Aleutian Islands of Alaska. *PLoS ONE*, 5:e12396.
327. Carpenter, DO. (2010) Human health effects of EMFs: The cost of doing nothing. *IOP Conf. Series: Earth and Environmental Science* 10: 012004. doi:10.1088/1755-1315/10/1/10/012004.
328. Goncharov A, Bloom M, Pavuk M, Birman I and Carpenter DO for the Anniston Environmental Health Research Consortium. Blood pressure and hypertension in relation to levels of serum polychlorinated biphenyls in residents of Anniston, Alabama. *J Hypertension.* 28: 2053-2060..
329. Prasad A, Ahs M, Goncharov A and Carpenter DO (2010) Omega-3 and omega-6 fatty acids kill thymocytes and increase membrane fluidity. *The Open Cell Development & Biology Journal* 3: 1-8

**DAVID CARPENTER
EXHIBIT A**

330. Sergeev AV and Carpenter DO (2010) Increased hospitalizations for ischemic stroke with comorbid diabetes and residential proximity to source of organic pollutants: A 12-year population-based study. *Neuroepidemiology* 35:196-201.
331. Prasad A, Bloom M and Carpenter DO (2010) Role of calcium and ROS in cell death induced by polyunsaturated fatty acids in murine thymocytes. *J Cell Physiol.* 225: 829-836.
332. Sergeev AV and Carpenter DO (2010) Geospatial patterns of hospitalization rates for stroke with comorbid hypertension in relation to environmental sources of persistent organic pollutants: Results from a 12-year population-based study. *Environ Sci Pollut Res Int* 18: 576-585.
333. Brown D, Goncharov A, Paul E, Simonin H and Carpenter DO. (2010) The relationships between Adirondack lake pH and levels of mercury in yellow perch. *J Aquat Animal Health.* 22:280-290.
334. Gavidia T, Brune M-N, McCarty KM, Pronczuk J, Etzel R, Neira M, Carpenter DO, Suk WA, Arnold RG, Ha EH, and Sly PD (2010) Children's environmental health – from knowledge to action. *Lancet* 377:1134-1136.
335. Bushkin-Bedient S and Carpenter DO (2010) Benefits versus risks associated with consumption of fish and other seafood. *Rev Environ Health* 25: 161-191.
336. Goncharov A, Pavuk M, Foushee HR and Carpenter DO for the Anniston Environmental Health Consortium (2010) Blood pressure in relation to concentrations of PCB congeners and chlorinated pesticides. *Environ Health Perspect.* 119:319-325.
337. Yilmaz B, Sandal S and Carpenter DO (2010) PCB 9 exposure induces endothelial cell death while increasing intracellular calcium and ROS levels. *Environ Toxicol.* In press. doi: 10.1002/tox.20676.
338. Sly PD, Arnold RG and Carpenter DO (2011) Environmental exposures in the era of climate change. *Rev Environ Health* 26: 1-4.
339. Carpenter DO (2011) Health effects of persistent organic pollutants: The challenge for the Pacific Basin and for the World. *Rev Environ Health* 26: 61-69.
340. Sergeev AV and Carpenter DO (2011) Increase in metabolic syndrome-related hospitalizations in relation to environmental sources of persistent organic pollutants. *Int J Environ Res Public Health* 8:762-776.
341. Carpenter DO, Miller PK, Waghiyi, Welfinger-Smith G (2011) Environmental contamination of the Yupik people of St. Lawrence Island, Alaska. *J Indigenous Res* In Press.
342. Carpenter DO (2010) Human health effects of EMFs: The cost of doing nothing. *IOP C Ser Earth Env* 10:1-6.
343. Kamalov J, Carpenter DO, Birman I (2011) Cytotoxicity of environmentally relevant concentrations of aluminum in murine thymocytes and lymphocytes. *J Toxicol.* Doi:10.1155/2011/796719.
344. Silbernagel S, Carpenter DO, Gilbert SG, Gochfeld M, Groth E, Hightower JM, Schiavone FM. (2011) Recognizing and preventing over exposure to methylmercury from fish and seafood consumption: Information for physicians. *J Toxicol*, 2011; doi:10.1155/2011/983072
345. Welfinger-Smith G, Minholz JL, Byrne S, Waghiyi V, Gologergen J, Kava J, Apatiki M, Ungott E, Miller PK, Arnason J and Carpenter DO. (2011) Organochlorine and metal contaminants in traditional foods from St. Lawrence Island, Alaska. *J Toxicol Environ Health A.* 74: 1-20.
346. Åhs M, Prasad A, Aminov Z and Carpenter DO (2011) Mechanisms of cell death of thymocytes induced by polyunsaturated, monounsaturated and trans-fatty acids. *J Cell. Biochem.* 112: 3863-3871.

**DAVID CARPENTER
EXHIBIT A**

347. Boberg E, Lessner L and Carpenter DO. (2011) The role of residence near hazardous waste sites containing benzene in the development of hematologic cancers in upstate New York. *Int J Occup Med Environ Health*. 24: 1-12..
348. Turyk ME, Bhazsar SP, Bowerman W, Boysen E, Clark M, Diamond M, Mergler D, Pantazopoulos P, Schantz S and Carpenter DO (2012) Risks and benefits of consumption of Great Lakes fish. *Environ Health Perspect*. 120: 11-18.
349. Ma J, Lessner L, Schreiber J and Carpenter DO (2009) Association between residential proximity to PERC dry cleaning establishments and kidney cancer in New York city. *J Environ Public Health* doi:10.1155/2009/183920.
350. Morse GS, Duncan G, Noonan C, Carroutte E, Santiago-Rivera A, Carpenter DO and Tarbell A (2011) *J Indigen Res* 1: (1) Article 6. <http://digitalcommons.usu.edu/kicjir/vol1/iss1/6>.
351. Liu X, Lessner L and Carpenter DO (2012) Association between residential proximity to fuel-fired power plants and hospitalization rate for respiratory diseases. *Environ Health Perspect* 120: 807-810.
352. Ruzzin J, Lee D-H, Carpenter DO and Jacobs DR Jr. (2012) Reconsidering metabolic disease: The impact of persistent organic pollutants. *Atherosclerosis* 224: 1-3.
353. Florea A-M, Busselberg D and Carpenter D (2012) Metals and disease. *J Toxicol* 2012. Doi:10.1155/2012/825354.
354. Smolyaninova LV, Carpenter DO, Dergalev AA, Kulebyakin KY and Boldyrev AA (2012) Carnosine prevents necrotic and apoptotic death of rat thymocytes via ouabain sensitive Na/K-ATPase. *Cell Biochem Funct*. DOI: 10.1002/cbf.2856.
355. Khwaja HA, Fatmi Z, Malashock D, Aminov Z, Siddique A and Carpenter DO (2012) Effect of air pollution on daily morbidity in Karachi, Pakistan. *J Local Global Health Science*, In press.
356. Scrudato RJ, Chiarenzelli FR, Miller PK, Alexander CR, Arnason J, Zamzow K, Zweifel K, Gologergen J, Kava J, Waghiyi V and Carpenter DO. (2012) Contaminants at Arctic formerly used defense sites. *J Local Global Health Science*. In press.
357. Hoover E, Cook K, Plain R, Sanchez K, Waghiyi V, Miller P, Dufault R, Sislin C and Carpenter DO (2012) Indigenous peoples of North America: Environmental exposures and reproductive justice. *Environ Health Perspect*. 120: 1645-1649.
358. Pantazopoulos P, Sawyer JM, Turyk ME, Diamond M, Bhavsar SP, Mergler D, Schantz S, Ratnayake N and Carpenter DO (2012) Fatty acids in Great Lakes lake trout and whitefish. *J Great Lakes Res*. In press.

Books:

1. Cellular Pacemakers I: Mechanisms of Pacemaker Generation, David O. Carpenter, editor; John Wiley & Sons, New York, 1982.
2. Cellular Pacemakers II: Function in Normal and Disease States, David O. Carpenter, editor; John Wiley & Sons, New York 1982.
3. Biologic Effects of Electric and Magnetic Fields, Volume I: Sources and Mechanisms of Biologic Effects, David O. Carpenter and Sinerik Ayrapetyan, editors; Academic Press, California, 1994.
4. Biologic Effects of Electric and Magnetic Fields, Volume II: Beneficial and Harmful Effects, David O. Carpenter and Sinerik Ayrapetyan, editors; Academic Press, California, 1994.
5. Environmental Challenges in the Pacific Basin, David O. Carpenter, ed. New York Academy of Sciences, Vol 1140, 457 pp, 2008.

DAVID CARPENTER EXHIBIT A

6. Effects of Persistent and Bioactive Organic Pollutants on Human Health. David O. Carpenter, ed. Wiley-Blackwell, In press, 2013.

Reviews and Book Chapters:

1. Carpenter, D.O. Ionic mechanisms and models of endogenous discharge of Aplysia neurons. Proceedings of the Symposium on Neurobiology of Invertebrates: Mechanisms of Rhythm Regulation. Tihany, Hungary, August 2-5, 1971, Hungarian Academy of Sciences, pp. 35-58, 1973.
2. Carpenter, D.O., Hovey, M.M. and Bak, A.F. Measurements of intracellular conductivity in Aplysia neurons: Evidence for organization of water and ions. Ann. NY Acad. Sci., 204:502-533, 1973.
3. Carpenter, D.O., Hubbard, J.H., Humphrey, D.R., Thompson, H.K. and Marshall, W.H. CO₂ effects on nerve cell function. In: Topics in Environmental Physiology and Medicine: Carbon Dioxide and Metabolic Regulation. (Eds.: G. Nahas and K.A. Schaefer), Springer-Verlag, New York, pp. 49-62, 1974.
4. Parmentier, J. and Carpenter, D.O. Blocking action of snake venom neurotoxins at receptor sites to putative central nervous system transmitters. In: Animal, Plant and Microbial Toxins (Eds.: A. Ohaska, K. Hayashi, and Y. Sawai), Plenum Press, London, Vol. 2, pp. 179-191, 1976.
5. Pierau, Fr.-K. and Carpenter, D.O. Metabolic control of peripheral temperature receptors in the scrotal skin of the rat. Israel J. Med. Sci., 12:1044-1046, 1976.
6. Carpenter, D.O. Membrane Excitability: In: Mammalian Cell Membranes Vol. 4, Membranes and Cellular Functions, (Eds.: G.A. Jamieson and D.M. Robinson), Butterworth & Co., London, pp. 184-206, 1977.
7. Carpenter, D.O., Myers, P.R., Shain, W., Sinback, C.N. and Swann, J.W. Interchangeable association of neurotransmitter receptors and ionophores in vertebrate and invertebrate cells. Proc. Symposium: "Iontophoresis and Transmitter Mechanisms in the Mammalian Central Nervous System", Cambridge, England, Raven Press, pp. 203-205, 1978.
8. Carpenter, D.O., McCreery, M.J., Woodbury, C.M. and Yarowsky, P.J. Modulation of endogenous discharge in neuron R-15 through specific receptors for several neurotransmitters. In: Abnormal Neuronal Discharges, (Eds.: N. Chalazonitis and M. Boisson), Raven Press, New York, pp. 189-203, 1978.
9. Tsien, R.W. and Carpenter, D.O. Ionic mechanisms of pacemaker activity in cardiac purkinje fibers. Fed. Proc., 37:2127-2131, 1978.
10. Keabian, P.R., Keabian, J.W. and Carpenter, D.O. Serotonin causes accumulation of cyclic AMP in Aplysia heart. The Proceedings of the Fourth International Catecholamine Symposium, (Eds.: E. Usdin and I. Kopin), Pergamon Press, New York, pp. 1167-1169.
11. Braitman, D.J., Auker, C.R. and Carpenter, D.O. Direct and modulatory actions of thyrotropin-releasing hormone (TRH) in sensorimotor cortex. Proc. EMBO Workshop on Drug Receptors in the Central Nervous System, Weizman Institute of Science, Rehovot, Israel, February 10-14, 1980.
12. Carpenter, D.O. Ionic and metabolic bases of neuronal thermosensitivity. Fed. Proc., 40:2808-2813, 1981.
13. Carpenter, D.O. and Reese, T.S. Chemistry and Physiology of Synaptic Transmissions. In: Basic Neurochemistry, 3rd Edition, (Eds.: Siegel, Albers, Agranoff and Katzman), Little, Brown and Company, pp. 161-168, 1981.
14. Shain, W. and Carpenter, D.O. Mechanisms of synaptic modulation. Intl. Rev. Neurobiol., 22:205-247, 1981.

DAVID CARPENTER
EXHIBIT A

15. Wiederhold, M.L. and Carpenter, D.O. Possible Role of Pacemaker Mechanisms in Sensory Systems. In: Cellular Pacemakers II: Function in Normal and Disease States, (Ed.: D.O. Carpenter), John Wiley & Sons, New York, pp. 27-58, 1982.
16. Carpenter, D.O. The generator potential mechanism in cold afferents may be an electrogenic sodium pump. Workshop on Mechanisms of Thermal Regulations. J. Therm. Biol., 387-390, 1983.
17. Carpenter, D.O. and Gregg, R.A. Functional significance of electrogenic pumps in neurons. In: Electrogenic transport: Fundamental Principles and Physiological Implications, (Eds.: M. Blaustein and M. Liebermann), Raven Press, pp. 253-270, 1984.
18. Carpenter, D.O., Briggs, D.B. and Strominger, N. Behavioral and electrophysiological studies of peptide-induced emesis in dogs. Fed. Proc., 43:16-18, 1984.
19. Coyle, J.T., Blakeley, R.D., Zaczeck, R., Ory-Lavallee, L., Koller, K., French-Mullen, J.M.H. and Carpenter, D.O. Acidic peptides in brain: Do they act at putative glutamatergic synapses. In: Excitatory Amino Acids and Epilepsy, (Eds.: Y. Ben-Ari and R. Schwarcz), Plenum Press, New York, pp. 375-384.
20. Carpenter, D.O., French-Mullen, J.M.H., Hori, N., Sinback, C.N. and Shain, W. Segregation of synaptic function on excitable cells. In: Neural Mechanisms of Conditioning, (Eds.: D. Alkon and C.D. Woody), Plenum Press, NY, pp. 355-369, 1985.
21. Carpenter, D.O. and Hall, A.F. Responses of Aplysia cerebral ganglion neurons to leucine enkephalin. In: Comparative Aspects of Opioid and Related Neuropeptide Mechanisms, (Eds.: M. Leung and G. Stefano), CRC Press, pp. 49-57.
22. Zaczeck, R., Koller, K., Carpenter, D.O., Fisher, R., French-Mullen, J.M.H. and Coyle, J.T. Interactions of acidic peptides: Excitatory amino acid receptors. In: Excitatory Amino Acids, (Ed.: P.J. Roberts), Macmillan, London, 1987.
23. Carpenter, D.O. Central nervous system mechanisms in deglutition and emesis. In: Handbook of Physiology, Section 6: The Gastrointestinal System. Vol. I, Motility and Circulation, (Ed.: J.D. Wood), American Physiological Society, Chapter 18, pp. 685-714, 1989.
24. Carpenter, D.O., Briggs, D.B. and Strominger, N. Mechanisms of radiation-induced emesis in the dog. Pharmacol. Ther., 39:367-371, 1988.
25. Carpenter, D.O. Comparative biology of neurotransmitter functions. Biology International, 15:2-9, 1987.
26. Carpenter, D.O. Electromagnetic Fields: Do We Know Enough to Act? In: Health and Environmental Digest, Vol. 2, pp. 3-4, 1988.
27. Carpenter, D.O. The New York State Power Lines Project: Summary and Conclusions. In: 20th Annual National Conference on Radiation Control, CRCPD Publication 88-6, Nashville, Tennessee, May 15-19, 1988, pp. 399-409.
28. S.-Rozsa, K., Carpenter, D.O., Stefano, G.B. and Salanki, J. Distinct responses to opiate peptides and FMRFamide on B-neurons of the Aplysia cerebral ganglia. In: Comparative Aspects of Neuropeptide Function, (Eds. E. Florey and G.B. Stefano), Manchester University Press, Chapter 6, pp. 73-86, 1991.
29. Carpenter, D.O. A common mechanism of excitation of area postrema neurons by several neuropeptides, hormones and monoamines. In: Comparative Aspects of Neuropeptide Function, (Eds. E. Florey and G.B. Stefano) Manchester University Press, Chapter 21, pp. 260-270, 1991.
30. Carpenter, D. O., Hirotsu, I., Katsuda, N. and Hori, N. The effects of acetylcholine and aging on electrical excitability of the central nervous system. In: Neuroregulatory Mechanisms in Aging, Pergamon Press LTD, pp. 5-23, 1993.

**DAVID CARPENTER
EXHIBIT A**

31. Turner, J.N., Swann, J.W., Szarowski, D.H., Smith, K.L., Shain, W., Carpenter, D.O. and Fejtl, M. Three-dimensional confocal light and electron microscopy of neurons: fluorescent and reflection stains. Methods in Cell Biology, 38:345-366, 1993.
32. Deno, D. and Carpenter, D.O. Sources and characteristics of electric and magnetic fields in the environment. In: Biologic Effects of Electric and Magnetic Fields, Volume I: Sources and Mechanisms of Biologic Effects, David O. Carpenter and Sinerik Ayrapetyan, editors, Academic Press, California, pp. 3-59, 1994.
33. Carpenter, D.O. The public health implications of magnetic field effects on biological systems. In: Biologic Effects of Electric and Magnetic Fields, Volume II: Beneficial and Harmful Effects, David O. Carpenter and Sinerik Ayrapetyan, editors, Academic Press, California, pp. 321-329, 1994.
34. Carpenter, D.O. Multidisciplinary study of hazardous wastes at a Great Lakes Superfund Site. Great Lakes Research Review, 1: 37-39, 1994.
35. Fejtl, M. and Carpenter, D.O. Single-channel studies in molluscan neurons. In: Ion Channels, Vol. 4, Toshio Narahashi, ed., Plenum Press, New York, pp. 333-376, 1996.
36. Turner, J.N., Swann, J.W., Szarowski, D.H., Smith, K.L., Shain, W., Carpenter, D.O. and Fejtl, M. Three-dimensional confocal light and electron microscopy of central nervous system tissue, and neurons and glia in culture. In: International Review of Experimental Pathology, V.J. Savin and T.B. Wiegmann, editors, Volume 36, Academic Press, pp. 53-72, 1996.
37. Boldyrev, A., Lawrence, D. and Carpenter, D. Effect of carnosine and its natural derivatives on apoptosis of neurons induced by excitotoxic compounds. In: Peptide Science-Present and Future, Y. Shimonishi, editor, Kluwer Academic Publishers, Great Britain, pp. 424-426, 1998.
38. Carpenter, D.O., Hussain, R., Tan, Y., Niemi, W. and Hori, N. Long-term potentiation and long-term depression: Relevance to learning and memory. In: Modern Problems of Cellular and Molecular Biophysics, S.N. Ayrapetyan and A.C.T. North, editors, Nayan Tapan, pp. 83-94, 2001.
39. Carpenter, D.O. NMDA receptors and molecular mechanisms of excitotoxicity. In: Oxidative Stress at Molecular, Cellular and Organ Levels, A. Boldyrev and P. Johnson, editors, Research Signpost, pp. 77-88, 2002.
40. Carpenter, D.O. Clearing the air: Asthma an indoor exposure. JNMA 96: 1-2, 2004.
41. Carpenter DO. Environmental contaminants and human health: The health effects of persistent toxic substances. Firat Tip Dergisi 10: ____: 2005.
42. Hermanson MH, Johnson GW and Carpenter DO. Routes of human exposure to PCBs in Anniston, Alabama. ACS Division of Environmental Chemistry, 232rd National Meeting, 46: 1117-1122, 2006
43. Carpenter DO and Welfinger-Smith G. The Hudson River: A case study of PCB contamination. In: Water and Sanitation-Related diseases and the Environment: Challenges, Interventions, and Preventative Measures. Janine M.H. Selendy, Ed., Wiley & Sons, Inc. 2011, pp 303-327.
44. Welfinger-Smith G and Carpenter DO. Addressing sources of PCBs and other chemical pollutants in water. In: Water and Sanitation-Related diseases and the Environment: Challenges, Interventions, and Preventative Measures. Janine M.H. Selendy, Ed., Wiley & Sons, Inc. 2011, pp 359-384.

Other Publications:

1. Barker, J.L. and Carpenter, D.O. Neuronal thermosensitivity. Science, 172:1361-1362, 1971.

DAVID CARPENTER
EXHIBIT A

2. Carpenter, D.O. Cellular Pacemakers. Fed. Proc., 37:2125-2126, 1978.
3. Carpenter, D.O. Membrane biophysics and general neurobiology in Japan. ONR Tokyo Scientific Bulletin, 3:23-27, 1978.
4. Carpenter, D.O. Research on the primate nervous system in Japan. ONR Tokyo Scientific Bulletin, 3:28-32, 1978.
5. Carpenter, D.O. Report on the Sixth International Biophysics Congress, Kyoto, Japan. ONR Tokyo Scientific Bulletin, 3:38-40, 1978.
6. Carpenter, D.O. Interchangeable association of neurotransmitter receptors with several ionophores. Brain Research Bulletin, 4:149-152, 1978.
7. Carpenter, D.O. and Ahlbom, A. Power lines and cancer: Public health and policy implications. Forum, 3:96-101, 1988.
8. Carpenter, D.O. Setting Health Policy When the Science and the Risk are Uncertain. In: The Scientific Basis of Health Policy in the 1990s, Proceedings of the School of Public Health's Fifth Anniversary Symposium, 54-63, 1990.
9. Carpenter, D.O. Integrating public health in professional education. Optometry and Vision Science, 70: 699-702, 1993.
10. Bowerman, W.W., Carey, J., Carpenter, D.O., Colborn, T., DeRosa, C., Fournier, M., Fox, G.A., Gibson, B.L., Gilbertson, M., Henshel, D., McMaster, S. and Upshur, R. Is it time for a Great Lakes Ecosystem Agreement separate from the Great Lakes Water Quality Agreement? J. Great Lakes Res. 25:237-238, 1999.
11. Carpenter, D.O. Editorial Comment of APrimary hypoxic tolerance and chemical preconditioning during estrus cycle@. Stroke, 30:1262, 1999.
12. Carpenter, D.O. Bring environmental health back into public Health. J. Pub. Health Mgmt. Pract., 5:vii-viii, 1999.
13. Carpenter, D.O. Should children and women of childbearing age eat Great Lakes fish? Great Lakes Commission Advisor, 13: 8, 2000.
14. Hites, R.A., Foran, J.A., Schwager, S.J., Knuth, B.A., Hamilton, M.C. and Carpenter, D.O. Response to comment on AGlobal Assessment of Polybrominated Diphenyl Ethers in Farmed and Wild Salmon@. Environ. Sci. Technol. 39: 379-380.
15. Carpenter, D.O. Blood lead and IQ in older children. Letter to the editor. Environ. Health Perspect., 113: A581-A582, 2005.
16. Foran, J.A., Carpenter, D.O., Good, D.H., Hamilton, M.C., Hites, R.A., Knuth, B.A. and Schwager, S.J. Risks and benefits of seafood consumption. Letter to the editor. Am. J. Prev. Med. 30: 438-439, 2006.
17. Bolte G, Kohlihuber M, Carpenter DO and Tamburlini G Environmental inequalities among children and adolescents in Europe. Report prepared and submitted to the World Health Organization, 2009.
18. Toxins and the Brain. PSR's Environmental Health Policy Institute, 9 April 2012

**CARPENTER DEPO
EXHIBIT 4**

Reported Biological Effects from Radiofrequency Radiation at Low-Intensity Exposure
(Cell Tower, Wi-Fi, Wireless Laptop and 'Smart' Meter RF Intensities)

CARPENTER EXHIBIT B

Power Density (Microwatts/centimeter² - uW/cm²)	Reference
As low as (10 ⁻¹³) or 100 femtowatts/cm ²	Super-low intensity RFR effects at MW resonant frequencies resulted in changes in genes; problems with chromatin conformation (DNA) Belyaev, 1997
5 picowatts/cm ² (10 ⁻¹²)	Changed growth rates in yeast cells Grundler, 1992
0.1 nanowatt/cm ² (10 ⁻¹⁰) or 100 picowatts/cm ²	Super-low intensity RFR effects at MW resonant frequencies resulted in changes in genes; problems with chromatin condensation (DNA) intensities comparable to base stations Belyaev, 1997
0.00034 uW/cm ²	Chronic exposure to mobile phone pulsed RF significantly reduced sperm count, Behari, 2006
0.0005 uW/cm ²	RFR decreased cell proliferation at 960 MHz GSM 217 Hz for 30-min exposure Velizarov, 1999
0.0006 - 0.0128 uW/cm ²	Fatigue, depressive tendency, sleeping disorders, concentration difficulties, cardio-vascular problems reported with exposure to GSM 900/1800 MHz cell phone signal at base station level exposures. Oberfeld, 2004
0.0009 uW/cm ²	RFR induced 10%-40% increase in DNA synthesis in glioma cells (brain) Stagg, 1997
0.003 - 0.02 uW/cm ²	In children and adolescents (8-17 yrs) short-term exposure caused headache, irritation, concentration difficulties in school. Heinrich, 2010
0.003 to 0.05 uW/cm ²	In children and adolescents (8-17 yrs) short-term exposure caused conduct problems in school (behavioral problems) Thomas, 2010
0.005 uW/cm ²	In adults (30-60 yrs) chronic exposure caused sleep disturbances, (but not significantly increased across the entire population) Mohler, 2010
0.005 - 0.04 uW/cm ²	Adults exposed to short-term cell phone radiation reported headaches, concentration difficulties (differences not significant, but elevated) Thomas, 2008
0.006 - 0.01 uW/cm ²	Chronic exposure to base station RF (whole-body) in humans showed increased stress hormones; dopamine levels substantially decreased; higher levels of adrenaline and nor-adrenaline; dose-response seen; produced chronic physiological stress in cells even after 1.5 years. Buchner, 2012
0.01 - 0.11 uW/cm ²	RFR from cell towers caused fatigue, headaches, sleeping problems Navarro, 2003

Stress proteins, HSP, disrupted immune function	Brain tumors and blood-brain barrier
Reproduction/fertility effects	Sleep, neuron firing rate, EEG, memory, learning, behavior
Oxidative damage/ROS/DNA damage/DNA repair failure	Cancer (other than brain), cell proliferation
Disrupted calcium metabolism	Cardiac, heart muscle, blood-pressure, vascular effects

Reported Biological Effects from Radiofrequency Radiation at Low-Intensity Exposure (Cell Tower, Wi-Fi, Wireless Laptop and 'Smart' Meter RF Intensities)

Power Density (Microwatts/centimeter ² - uW/cm ²)	Reference
0.01 - 0.05 uW/cm ²	Adults (18-91 yrs) with short-term exposure to GSM cell phone radiation reported headache, neurological problems, sleep and concentration problems. Hutter, 2006
0.005 - 0.04 uW/cm ²	Adults exposed to short-term cell phone radiation reported headaches, concentration difficulties (differences not significant, but elevated) Thomas, 2008
0.015 - 0.21 uW/cm ²	Adults exposed to short-term GSM 900 radiation reported changes in mental state (e.g., calmness) but limitations of study on language descriptors prevented refined word choices (stupidified, zoned-out) Augner, 2009
0.05 - 0.1 uW/cm ²	RFR linked to adverse neurological, cardio symptoms and cancer risk Khurana, 2010
0.05 - 0.1 uW/cm ²	RFR related to headache, concentration and sleeping problems, fatigue Kundi, 2009
0.07 - 0.1 uW/cm ²	Sperm head abnormalities in mice exposed for 6-months to base station level RF/MW. Sperm head abnormalities occurred in 39% to 46% exposed mice (only 2% in controls) abnormalities was also found to be dose dependent. The implications of the pin-head and banana-shaped sperm head. The occurrence of sperm head observed increase occurrence of sperm head abnormalities on the reproductive health of humans living in close proximity to GSM base stations were discussed." Ottolouju, 2010
0.38 uW/cm ²	RFR affected calcium metabolism in heart cells Schwartz, 1990
0.8 - 10 uW/cm ²	RFR caused emotional behavior changes, free-radical damage by super-weak MWS Akoev, 2002
0.13 uW/cm ²	RFR from 3G cell towers decreased cognition, well-being Zwamborn, 2003
0.16 uW/cm ²	Motor function, memory and attention of school children affected (Latvia) Kolodynski, 1996
0.168 - 1.053 uW/cm ²	Irreversible infertility in mice after 5 generations of exposure to RFR from an 'antenna park' Magras & Zenos, 1997
0.2 - 8 uW/cm ²	RFR caused a two-fold increase in leukemia in children Hocking, 1996
0.2 - 8 uW/cm ²	RFR decreased survival in children with leukemia Hocking, 2000
0.21 - 1.28 uW/cm ²	Adolescents and adults exposed only 45 min to UMTS cell phone radiation reported increases in headaches. Riddervold, 2008

Stress proteins, HSP, disrupted immune function	Brain tumors and blood-brain barrier
Reproduction/fertility effects	Sleep, neuron firing rate, EEG, memory, learning, behavior
Oxidative damage/ROS/DNA damage/DNA repair failure	Cancer (other than brain), cell proliferation
Disrupted calcium metabolism	Cardiac, heart muscle, blood-pressure, vascular effects

Reported Biological Effects from Radiofrequency Radiation at Low-Intensity Exposure (Cell Tower, Wi-Fi, Wireless Laptop and 'Smart' Meter RF Intensities)

Power Density (Microwatts/centimeter ² - uW/cm ²)		Reference
0.5 uW/cm ²	Significant degeneration of seminiferous epithelium in mice at 2.45 GHz, 30-40 min.	Saunders, 1981
0.5 - 1.0 uW/cm ²	Wi-Fi level laptop exposure for 4-hr resulted in decrease in sperm viability, DNA fragmentation with sperm samples placed in petri dishes under a laptop connected via Wi-Fi to the internet.	Avendano, 2012
1.0 uW/cm ²	RFR induced pathological leakage of the blood-brain barrier	Persson, 1997
1.0 uW/cm ²	RFR caused significant effect on immune function in mice	Fesenko, 1999
1.0 uW/cm ²	RFR affected function of the immune system	Novoselova, 1999
1.0 uW/cm ²	Short-term (50 min) exposure in electrosensitive patients, caused loss of well-being after GSM and especially UMTS cell phone radiation exposure	Elititi, 2007
1.3 - 5.7 uW/cm ²	RFR associated with a doubling of leukemia in adults	Dolk, 1997
1.25 uW/cm ²	RFR exposure affected kidney development in rats (in-utero exposure)	Pyrpasopoulou, 2004
1.5 uW/cm ²	RFR reduced memory function in rats	Nitthy, 2007
2 uW/cm ²	RFR induced double-strand DNA damage in rat brain cells	Kesari, 2008
2.5 uW/cm ²	RFR affected calcium concentrations in heart muscle cells	Wolke, 1996
2 - 4 uW/cm ²	Altered cell membranes; acetylcholine-induced ion channel disruption	D'Inzeo, 1988
4 uW/cm ²	RFR caused changes in hippocampus (brain memory and learning)	Tattersall, 2001
4 - 15 uW/cm ²	Memory impairment, slowed motor skills and retarded learning in children	Chiang, 1989
5 uW/cm ²	RFR caused drop in NK lymphocytes (immune function decreased)	Boscolo, 2001
5.25 uW/cm ²	20 minutes of RFR at cell tower frequencies induced cell stress response	Kwee, 2001
5 - 10 uW/cm ²	RFR caused impaired nervous system activity	Dumansky, 1974
6 uW/cm ²	RFR induced DNA damage in cells	Phillips, 1998

Stress proteins, HSP, disrupted immune function	Brain tumors and blood-brain barrier
Reproduction/fertility effects	Sleep, neuron firing rate, EEG, memory, learning, behavior
Oxidative damage/ROS/DNA damage/DNA repair failure	Cancer (other than brain), cell proliferation
Disrupted calcium metabolism	Cardiac, heart muscle, blood-pressure, vascular effects

CARPENTER EXHIBIT B

Reported Biological Effects from Radiofrequency Radiation at Low-Intensity Exposure

(Cell Tower, Wi-Fi, Wireless Laptop and 'Smart' Meter RF Intensities)

Power Density (Microwatts/centimeter ² - uW/cm ²)	Reference
8.75 uW/cm ²	RFR at 900 MHz for 2-12 hours caused DNA breaks in leukemia cells Marinelli, 2004
10 uW/cm ²	Changes in behavior (avoidance) after 0.5 hour exposure to pulsed RFR Navakatikian, 1994
10 - 100 uW/cm ²	Increased risk in radar operators of cancer; very short latency period; dose response to exposure level of RFR reported. Richter, 2000
12.5 uW/cm ²	RFR caused calcium efflux in cells - can affect many critical cell functions Dutta, 1989
13.5 uW/cm ²	RFR affected human lymphocytes - induced stress response in cells Sarimov, 2004
14.75 uW/cm ²	RFR increased biomarker for cell division in glioma brain tumor cells Stagg, 1997
20 uW/cm ²	Increase in serum cortisol (a stress hormone) Mann, 1998
28.2 uW/cm ²	RFR increased free radical production in rat cells Yurekli, 2006
37.5 uW/cm ²	Immune system effects - elevation of PFC count (antibody producing cells) Veyret, 1991
45 uW/cm ²	Pulsed RFR affected serum testosterone levels in mice Forgacs, 2006
50 uW/cm ²	Cell phone RFR caused a pathological leakage of the blood-brain barrier in 1 hour Salford, 2003
50 uW/cm ²	An 18% reduction in REM sleep (important to memory and learning functions) Mann, 1996
60 uW/cm ²	RFR caused structural changes in cells of mouse embryos Somozy, 1991
60 uW/cm ²	Pulsed RFR affected immune function in white blood cells Stankiewicz, 2006
60 uW/cm ²	Cortex of the brain was activated by 15 minutes of 902 MHz cell phone Lebedeva, 2000
65 uW/cm ²	RFR affected genes related to cancer Ivaschuk, 1999
92.5 uW/cm ²	RFR caused genetic changes in human white blood cells Belyaev, 2005
100 uW/cm ²	Changes in immune function Elekes, 1996
100 uW/cm ²	A 24.3% drop in testosterone after 6 hours of CW RFR exposure Navakatikian, 1994

Stress proteins, HSP, disrupted immune function	Brain tumors and blood-brain barrier
Reproduction/fertility effects	Sleep, neuron firing rate, EEG, memory, learning, behavior
Oxidative damage/ROS/DNA damage/DNA repair failure	Cancer (other than brain), cell proliferation
Disrupted calcium metabolism	Cardiac, heart muscle, blood-pressure, vascular effects

Reported Biological Effects from Radiofrequency Radiation at Low-Intensity Exposure (Cell Tower, Wi-Fi, Wireless Laptop and 'Smart' Meter RF Intensities)

Power Density (Microwatts/centimeter ² - uW/cm ²)		Reference
120 uW/cm ²	A pathological leakage in the blood-brain barrier with 915 MHz cell RF	Salford, 1994
500 uW/cm ²	Intestinal epithelial cells exposed to 2.45 GHz pulsed at 16 Hz showed changes in intercellular calcium.	Somozy, 1993
500 uW/cm ²	A 24.6% drop in testosterone and 23.2% drop in insulin after 12 hrs of pulsed RFR exposure.	Navakatikian, 1994
STANDARDS		
530 - 600 uW/cm ²	Limit for uncontrolled public exposure to 800-900 MHz	ANSI/IEEE and FCC
1000 uW/cm ²	PCS STANDARD for public exposure (as of September 1, 1997)	FCC, 1996
5000 uW/cm ²	PCS STANDARD for occupational exposure (as of September 1, 1997)	FCC, 1996
BACKGROUND LEVELS		
0.003 uW/cm ²	Background RF levels in US cities and suburbs in the 1990s	Mantiply, 1997
0.05 uW/cm ²	Median ambient power density in cities in Sweden (30-2000 MHz)	Hamnerius, 2000
0.1 - 10 uW/cm ²	Ambient power density within 100-200' of cell site in US (data from 2000)	Sage, 2000
Stress proteins, HSP, disrupted immune function	Brain tumors and blood-brain barrier	
Reproduction/fertility effects	Sleep, neuron firing rate, EEG, memory, learning, behavior	
Oxidative damage/ROS/DNA damage/DNA repair failure	Cancer (other than brain), cell proliferation	
Disrupted calcium metabolism	Cardiac, heart muscle, blood-pressure, vascular effects	

Reported Biological Effects from Radiofrequency Radiation at Low-Intensity Exposure (Cell Tower, Wi-Fi, Wireless Laptop and 'Smart' Meter RF Intensities)

SAR (Watts/Kilogram)	Reference
0.000064 - 0.000078 W/Kg	Well-being and cognitive function affected in humans exposed to GSM-UMTS cell phone frequencies; RF levels similar near cell sites TNO Physics and
0.000015 - 0.003 W/Kg	Calcium ion movement in isolated frog heart tissue is increased 18% ($P < .01$) and by 21% ($P < .05$) by weak RF field modulated at 16 Hz Schwartz, 1990
0.000021 - 0.0021 W/Kg	Changes in cell cycle; cell proliferation (960 MHz GSM mobile phone) Kwee, 1997
0.0003 - 0.06 W/Kg	Neurobehavioral disorders in offspring of pregnant mice exposed in utero to cell phones - dose-response impaired glutamatergic synaptic transmission, onto layer V pyramidal neurons of the prefrontal cortex. Hyperactivity and impaired memory function in offspring. Altered brain development. Aldad, 2012
0.0009 W/Kg	Changes in brain glial cells with TDMA 836.55 MHz frequency Staag, 1997
0.0016 - 0.0044 W/Kg	Very low power 700 MHz CW affects excitability of hippocampus tissue, consistent with reported behavioral changes. Tattersall, 2001
0.0021 W/Kg	Heat shock protein HSP 70 is activated by very low intensity microwave exposure in human epithelial amnion cells Kwee, 2001
0.0024 - 0.024 W/Kg	Digital cell phone RFR at very low intensities causes DNA damage in human cells; both DNA damage and impairment of DNA is reported Phillips, 1998
0.0027 W/Kg	Changes in active avoidance conditioned behavioral effect is seen after one-half hour of pulsed radiofrequency radiation Navakatikian, 1994
0.0035 W/Kg	900 MHz cell phone signal induces DNA breaks and early activation of p53 gene; short exposure of 2-12 hours leads cells to acquire greater survival chance - linked to tumor aggressiveness. Martinelli, 2004
0.0095 W/Kg	MW modulated at 7 Hz produces more errors in short-term memory function on complex tasks (can affect cognitive processes such as attention and memory) Lass, 2002
0.001 W/Kg	750 MHz continuous wave (CW) RFR exposure caused increase in heat shock protein (stress proteins). Equivalent to what would be induced by 3 degree C. heating of tissue (but no heating occurred) De Pomerai, 2000
Stress proteins, HSP, disrupted immune function	Brain tumors and blood-brain barrier
Reproduction/fertility effects	Sleep, neuron firing rate, EEG, memory, learning, behavior
Oxidative damage/ROS/DNA damage/DNA repair failure	Cancer (other than brain), cell proliferation
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Reported Biological Effects from Radiofrequency Radiation at Low-Intensity Exposure (Cell Tower, Wi-Fi, Wireless Laptop and 'Smart' Meter RF Intensities)

SAR (Watts/Kilogram)	Reference
0.001 W/Kg Statistically significant change in intracellular calcium concentration in heart muscle cells exposed to RFR (900 MHz/50 Hz modulation)	Wolke, 1996
0.0021 W/Kg A significant change in cell proliferation not attributable to thermal heating. RFR induces non-thermal stress proteins (960 MHz GSM)	Velizarov, 1999
0.004 - 0.008 W/Kg 915 MHz cell phone RFR caused pathological leakage of blood-brain barrier. Worst at lower SAR levels and worse with CW compared to Frequency of pathological changes was 35% in rats exposed to pulsed radiation at 50% to continuous wave RFR. Effects observed at a specific absorption (SA) of > 1.5 joules/Kg in human tissues	Persson, 1997
0.0059 W/Kg Cell phone RFR induces glioma (brain cancer) cells to significantly increase thymidine uptake, which may be indication of more cell division	Stagg, 1997
0.014 W/Kg Sperm damage from oxidative stress and lowered melatonin levels resulted from 2-hr per day/45 days exposure to 10 GHz.	Kumar, 2012
0.015 W/Kg Immune system effects - elevation of PFC count (antibody-producing cells)	Veyret, 1991
0.02 W/Kg A single, 2-hr exposure to GSM cell phone radiation results in serious neuron damage (brain cell damage) and death in cortex, hippocampus, and basal ganglia of brain- even 50+ days later blood-brain barrier is still leaking albumin (P<.002) following only one cell phone exposure	Salford, 2003
0.026 W/Kg Activity of c-jun (oncogene or cancer gene) was altered in cells after 20 minutes exposure to cell phone digital TDMA signal	Ivaschuk, 1997
0.0317 W/Kg Decrease in eating and drinking behavior	Ray, 1990
0.037 W/Kg Hyperactivity caused by nitric oxide synthase inhibitor is countered by exposure to ultra-wide band pulses (600/sec) for 30 min	Seaman, 1999
0.037 - 0.040 W/Kg A 1-hr cell phone exposure causes chromatin condensation; impaired DNA repair mechanisms; last 3 days (longer than stress response) the effect reaches saturation in only one hour of exposure; electro- sensitive (ES) people have different response in formation of DNA repair foci, compared to healthy individuals; effects depend on carrier frequency (915 MHz = 0.037 W/Kg but 1947 MHz = 0.040 W/Kg)	Belyaev, 2008

Stress proteins, HSP, disrupted immune function	Brain tumors and blood-brain barrier
Reproduction/fertility effects	Sleep, neuron firing rate, EEG, memory, learning, behavior
Oxidative damage/ROS/DNA damage/DNA repair failure	Cancer (other than brain), cell proliferation
Disrupted calcium metabolism	Cardiac, heart muscle, blood-pressure, vascular effects

Reported Biological Effects from Radiofrequency Radiation at Low-Intensity Exposure (Cell Tower, Wi-Fi, Wireless Laptop and 'Smart' Meter RF Intensities)

SAR (Watts/Kilogram)	Reference
0.05 W/Kg	Significant increase in firing rate of neurons (350%) with pulsed 900 MHz cell phone radiation exposure (but not with CW) in avian brain cells Beason, 2002
0.09 W/Kg	900 MHz study of mice for 7 days, 12-hr per day (whole-body) resulted in significant effect on mitochondria and genome stability Aitken, 2005
0.091 W/Kg	Wireless internet 2400 MHz, 24-hrs per day/20 weeks increased DNA damage and reduced DNA repair; levels below 802.11 g Authors say "findings raise questions about safety of radiofrequency exposure from Wi-Fi internet access devices for growing organisms of reproductive age, with a potential effect on fertility and integrity of germ cells" (male germ cells are the reproductive cells=sperm) Atasoy, 2012
0.11 W/Kg	Increased cell death (apoptosis) and DNA fragmentation at 2.45 GHz for 35 days exposure (chronic exposure study) Kesari, 2010
0.121 W/Kg	Cardiovascular system shows significant decrease in arterial blood pressure (hypotension) after exposure to ultra-wide band pulses Lu, 1999
0.13 - 1.4 W/Kg	Lymphoma cancer rate doubled with two 1/2-hr exposures per day of cell phone radiation for 18 months (pulsed 900 MHz cell signal) Repacholi, 1997
0.14 W/Kg	Elevation of immune response to RFR exposure Elekes, 1996
0.141 W/Kg	Structural changes in testes - smaller diameter of seminiferous Dasdag, 1999
0.15 - 0.4 W/Kg	Statistically significant increase in malignant tumors in rats chronically exposed to RFR Chou, 1992
0.26 W/Kg	Harmful effects to the eye/certain drugs sensitize the eye to RFR Kues, 1992
0.28 - 1.33 W/Kg	Significant increase in reported headaches with increasing use of hand-held cell phone use (maximum tested was 60 min per day) Chia, 2000
0.3 - 0.44 W/Kg	Cell phone use results in changes in cognitive thinking/mental tasks related to memory retrieval Krause, 2000
0.3 - 0.44 W/Kg	Attention function of brain and brain responses are speeded up Preece, 1999
0.3 - 0.46 W/Kg	Cell phone RFR doubles pathological leakage of blood-brain barrier permeability at two days (P=.002) and triples permeability at four days (P=.001) at 1800 MHz GSM cell phone radiation Schirmacher, 2000
Stress proteins, HSP, disrupted immune function	Brain tumors and blood-brain barrier
Reproduction/fertility effects	Sleep, neuron firing rate, EEG, memory, learning, behavior
Oxidative damage/ROS/DNA damage/DNA repair failure	Cancer (other than brain), cell proliferation
Disrupted calcium metabolism	Cardiac, heart muscle, blood-pressure, vascular effects

CARPENTER EXHIBIT B

Reported Biological Effects from Radiofrequency Radiation at Low-Intensity Exposure (Cell Tower, Wi-Fi, Wireless Laptop and 'Smart' Meter RF Intensities)

SAR (Watts/Kilogram)	Reference
0.43 W/Kg	Significant decrease in sperm motility; drop in sperm concentration; and decrease in seminiferous tubules at 800 MHz, 8-hr/day, 12 weeks, with mobile phone radiation level on STANDBY ONLY (in rabbits) Salama, 2008
0.5 W/Kg	900 MHz pulsed RF affects firing rate of neurons (Lymnea stagnalis) but continuous wave had no effect Bolshakov, 1992
0.58 - 0.75 W/Kg	Decrease in brain tumors after chronic exposure to RFR at 836 MHz Adey, 1999
0.6 - 0.9 W/Kg	Mouse embryos develop fragile cranial bones from in utero 900 MHz The authors say "(O)ur results clearly show that even modest exposure (e.g., 6 min daily for 21 days" is sufficient to interfere with the normal mouse developmental process" Fragopoulou, 2009
0.6 and 1.2 W/Kg	Increase in DNA single and double-strand DNA breaks in rat brain cells with exposure to 2450 MHz RFR Lai & Singh, 1996
0.795 W/Kg	GSM 900 MHz, 217 Hz significantly decreases ovarian development and size of ovaries, due to DNA damage and premature cell death of nurse cells and follicles in ovaries (that nourish egg cells) Panagopoulous, 2012
0.87 W/Kg	Altered human mental performance after exposure to GSM cell phone radiation (900 MHz TDMA digital cell phone signal) Hamblin, 2004
0.87 W/Kg	Change in human brainwaves; decrease in EEG potential and statistically significant change in alpha (8-13 Hz) and beta (13-22 Hz) brainwave activity in humans at 900 MHz; exposures 6/min per day for 21 days (chronic exposure) D'Costa, 2003
0.9 W/Kg	Decreased sperm count and more sperm cell death (apoptosis) after 35 days exposure, 2-hr per day Kesari, 2012
< 1.0 W/Kg	Rats exposed to mobile phone radiation on STANDBY ONLY for 11-hr 45-min plus 15-min TRANSMIT mode; 2 times per day for 21 days showed decreased number of ovarian follicles in pups born to these pregnant rats. The authors conclude "the decreased number of follicles in pups exposed to mobile phone microwaves suggest that intrauterine exposure has toxic effects on ovaries." Gul, 2009
0.4 - 1.0 W/Kg	One 6-hr exposure to 1800 MHz cell phone radiation in human sperm cells caused a significant dose response and reduced sperm motility and viability; reactive oxygen species levels were significantly increased after exposure to 1.0 W/Kg; study confirms detrimental effects of RF/MW to human sperm. The authors conclude "(T)hese findings have clear implications for the safety of extensive mobile phone use by males of reproductive age, potentially affecting both their fertility and the health and wellbeing of their offspring." De Iulius, 2009

Stress proteins, HSP, disrupted immune function	Brain tumors and blood-brain barrier
Reproduction/fertility effects	Sleep, neuron firing rate, EEG, memory, learning, behavior
Oxidative damage/ROS/DNA damage/DNA repair failure	Cancer (other than brain), cell proliferation
Disrupted calcium metabolism	Cardiac, heart muscle, blood-pressure, vascular effects

CARPENTER EXHIBIT B

Reported Biological Effects from Radiofrequency Radiation at Low-Intensity Exposure

(Cell Tower, Wi-Fi, Wireless Laptop and 'Smart' Meter RF Intensities)

SAR (Watts/Kilogram)	Reference
1.0 W/Kg	Human semen degraded by exposure to cell phone frequency RF increased free-radical damage. De Iulijs, 2009
1.0 W/Kg	Motility, sperm count, sperm morphology, and viability reduced in active cell phone users (human males) in dose-dependent manner. Agarwal, 2008
1.0 W/Kg	GSM cell phone use modulates brain wave oscillations and sleep EEG Huber, 2002
1.0 W/Kg	Cell phone RFR during waking hours affects brain wave activity. (EEG patterns) during subsequent sleep Achermann, 2000
1.0 W/Kg	Cell phone use causes nitric oxide (NO) nasal vasodilation (swelling inside nasal passage) on side of head phone use Paredi, 2001
1.0 W/Kg	Four-fold increase in eye cancer (uveal melanoma) in cell phone users Stang, 2001
1.0 W/Kg	Increase in headache, fatigue and hearing behind ear in cell phone users Sandstrom, 2001
1.0 W/Kg	Significant increase in concentration difficulties using 1800 MHz cell phone compared to 900 MHz cell phone Santini, 2001
1.0 W/Kg	Sleep patterns and brain wave activity are changed with 900 MHz cell phone radiation exposure during sleep Borbely, 1999
1.4 W/Kg	GSM cell phone exposure induced heat shock protein HSP 70 by 360% (stress response) and phosphorylation of ELK-1 by 390% Weisbrodt, 2003
1.46 W/Kg	850 MHz cell phone radiation decreases sperm motility, viability is significantly decreased; increased oxidative damage (free-radicals) significantly decreased; increased oxidative damage (free-radicals) Agarwal, 2009
1.48 W/Kg	A significant decrease in protein kinase C activity at 112 MHz with 2-hr per day for 35 days; hippocampus is site, consistent with reports that RFR negatively affects learning and memory functions Paulraj, 2004
1.0 - 2.0 W/Kg	Significant elevation in micronuclei in peripheral blood cells at 2450 MHz (8 treatments of 2-hr each) Trosic, 2002
1.5 W/Kg	GSM cell phone exposure affected gene expression levels in tumor suppressor p53-deficient embryonic stem cells; and significantly increased HSP 70 heat shock protein production Czyz, 2004

Stress proteins, HSP, disrupted immune function	Brain tumors and blood-brain barrier
Reproduction/fertility effects	Sleep, neuron firing rate, EEG, memory, learning, behavior
Oxidative damage/ROS/DNA damage/DNA repair failure	Cancer (other than brain), cell proliferation
Disrupted calcium metabolism	Cardiac, heart muscle, blood-pressure, vascular effects

CARPENTER EXHIBIT B

Reported Biological Effects from Radiofrequency Radiation at Low-Intensity Exposure (Cell Tower, Wi-Fi, Wireless Laptop and 'Smart' Meter RF Intensities)

SAR (Watts/Kilogram)	Reference
1.8 W/Kg	Whole-body exposure to RF cell phone radiation of 900-1800 MHz 1 cm from head of rats caused high incidence of sperm cell death; deformation of sperm cells; prominent clumping together of sperm cells into "grass bundle shapes" that are unable to separate/swim. Sperm cells unable to swim and fertilize in normal manner. Yan, 2007
2.0 W/Kg	GSM cell phone exposure of 1-hr activated heat shock protein HSP 27 (stress response) and P38 MAPK (mutagen-activated protein kinase) that authors say facilitates brain cancer and increased blood-brain barrier permeability, allowing toxins to cross BBB into brain Leszczynski, 2002
2 W/Kg	900 MHz cell phone exposure caused brain cell oxidative damage by increasing levels of NO, MDA, XO and ADA in brain cells; caused statistically significant increase in 'dark neurons' or damaged brain cells in cortex, hippocampus and basal ganglia with a 1-hr exposure for 7 consecutive days Ilhan, 2004
2.6 W/Kg	900 MHz cell phone exposure for 1-hr significantly altered protein expression levels in 38 proteins following irradiation; activates P38 MAP kinase stress signalling pathway and leads to changes in cell size and shape (shrinking and rounding up) and to activation of HSP 27, a stress protein (heat shock protein) Leszczynski, 2004
2.0 - 3.0 W/Kg	RFR accelerated development of both skin and breast tumors Szmigielski, 1982
2 W/Kg	Pulse-modulated RFR and MF affect brain physiology (sleep study) Schmidt, 2012
STANDARDS	
0.08 W/Kg	IEEE Standard uncontrolled public environment (whole body) IEEE
0.4 W/Kg	IEEE Standard controlled occupational environment (whole body) IEEE
1.6 W/Kg	FCC (IEEE) SAR limit for 1 gram of tissue in a partial body exposure FCC, 1996
2 W/Kg	ICNIRP SAR limit for 10 grams of tissue ICNIRP, 1996

Stress proteins, HSP, disrupted immune function	Brain tumors and blood-brain barrier
Reproduction/fertility effects	Sleep, neuron firing rate, EEG, memory, learning, behavior
Oxidative damage/ROS/DNA damage/DNA repair failure	Cancer (other than brain), cell proliferation
Disrupted calcium metabolism	Cardiac, heart muscle, blood-pressure, vascular effects

Reference List
Reported Biological Effects from Radiofrequency Radiation (RFR)
at Low-Intensity Exposure Levels
(Cell Tower, WI-FI, Wireless Laptop,
Wireless Utility Meters 'smart meters')

Prepared November 22, 2012 by:
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Acherman P et al, 2000. Exposure to pulsed high-frequency electromagnetic field during waking affects human sleep EEG. *NeuroReport* 11(15):3321-3325.

Adey,WR et al, 1999. Incidence of spontaneous and nitrosourea-induced primary tumors of the central nervous system in Fischer 344 rats chronically exposed to modulated microwaves. *Radiation Research* 152: 293-302.

Agarwal A, Deepinder F, Sharma RK, Ranga G, Li J.2008. Effect of cell phone usage on semen analysis in men attending infertility clinic: an observational study. *Fertil Steril.* 89(1): 124-8.

Agarwal A, Desai NR, Makker K, Varghese A, Mouradi R, Sabanegh E, Sharma R. 2009. Effects of radiofrequency electromagnetic waves (RF-EMW) from cellular phones on human ejaculated semen: an in vitro pilot study. *Fertil Steril.* 92(4) 1318-1325.

Aitken RJ, Bennetts LE, Sawyer D, Wiklendt AM, King BV. 2005 Impact of radio frequency electromagnetic radiation on DNA integrity in the male germline 28:171-179.

Akoev, IG et al, 2002. Enzymatic activity of some tissues and blood serum from animals and humans exposed to microwaves and hypothesis on the possible role of free radical processes in the nonlinear effects and modification of emotional behavior of animals. *Radiats Biol Radioecol*, 42(3):32-330.

Atasoy HI, Gunal MY, Atasoy P, Elgun S, Bugdayci G. 2012 Immunohistopathologic demonstration of deleterious effects on growing rat testes of radiofrequency waves emitted from conventional Wi-Fi devices. *J Pediatr Urol.* [Epub ahead of print]

Avendano C, Mata A, Sanchez Sarmiento CA, Doncei GF. 2012. Use of laptop computers connected to internet through Wi-Fi decreases human sperm motility and increases sperm DNA fragmentation. *Fertility and Sterility.* American Society for Reproductive Medicine, Published by Elsevier Inc. doi:10.1016/j.fertnstert.2011.10.012.

Beason, RC & Semm, P, 2002. Responses of neurons to an amplitude modulated microwave stimuli. *Neuroscience Letters* 333:175-178.

Behari J, Kesari KK 2006. Effects of microwave radiations on reproductive system of male rats. *Embryo Talk* 1 (Suppl.1):81-5.

Belokrinitsky, VS, 1982,. Destructive and reparative processes in hippocampus with long-term exposure to nonionizing radiation. In: U.S.S.R. Report, Effects of Nonionizing Microwave Radiation, No. 7, JPRS 81865, pp. 15-20.

Belyaev IY, Alipov YD, Harms-Ringdahl M. 1997. Effects of zero magnetic field on the conformation of chromatin in human cells. *Biochim Biophys Acta* 1336(3):465-473.

Belyaev IY, Hillert L, Protopopova M, Tamm C, Malmgren LO, Persson BR, Selivanova G, Harms-Ringdahl M. 2005. 915 MHz microwaves and 50 Hz magnetic field affect chromatin conformation and 53BP1 foci in human lymphocytes from hypersensitive and healthy persons. *Bioelectromagnetics*. 26(3):173-184.

Belyaev IY, Markova E, Hillert L, Malmgren LOG, Persson BRR. 2009. Microwaves from UMTS/GSM mobile phones induce long- lasting inhibition of 53BP1/γ-H2AX DNA repair foci in human lymphocytes. *Bioelectromagnetics* 30(2):129-41.

Bolshakov, MA & Alekseev, SI, 1992. Bursting responses of Lymnea neurons to microwave radiation. *Bioelectromagnetics* 13(2): 119-129.

Borbely, AA et al, 1999. Pulsed high-frequency electromagnetic field affects human sleep and sleep electroencephalogram. *Neuroscience Letters* 275(3): 207-210.

Boscato et al, 2001. Effects of electromagnetic fields produced by radiotelevision broadcasting stations on the immune system of women. *Sci Total Environ* 273(1-3):1-10.

Buchner K, Eger H., 2011. Changes of Clinically Important Neurotransmitters under the Influence of Modulated RF Fields—A Long-term Study under Real-life Conditions *Umwelt-Medizin-Gesellschaft* 24(1): 44-57. Original study in German.

Chia SE et al, 2000. Prevalence of headache among handheld cellular telephone users in Singapore: A Community Study. *Environmental Health Perspectives* 108(11):1059-1062.

Chiang, H et al, 1989. Health effects of environmental electromagnetic fields. *Journal of Bioelectricity* 8: 127-131.

Chou, CK et al, 1992. Long-term low level microwave irradiation of rats. *Bioelectromagnetics* 13:469-496.

Czyz J et al, 2004. High frequency electromagnetic fields (GSM signals) affect gene expression levels in tumor suppressor p53-deficient embryonic stem cells. *Bioelectromagnetics* 25: 296-307.

Dasdag, S et al, 1999. Whole-body microwave exposure emitted by cellular phones and testicular function of rats. *Urological Research* 27(3):219-223.

D'Costa, H et al. 2003. Human brain wave activity during exposure to radiofrequency field emissions from mobile phones. *Australasian Physical & Engineering Sciences in Medicine*, Vol. 26, No. 4

De Pomerai, D et al, 2000. Non-thermal heat-shock response to microwaves. *Nature* 405: 417-418.

D'Inzeo, G et al, 1988. Microwave effects on acetylcholine-induced channels in cultured chick myotubes. *Bioelectromagnetics* 9: 363-372.

De Iuliis GN, Newey RJ, King BV, Aitken RJ. 2009. Mobile phone radiation induces reactive oxygen species production and DNA damage in human spermatozoa in vitro. *PLoS One* 4(7):e6446.

Dolk, H et al, 1997. Cancer incidence near radio and television transmitters in Great Britain. *American Journal of Epidemiology* 145(1): 1-9.

Dumansky, JD & Shandala, MG, 1974. The biological action and hygenic significance of electromagnetic fields of superhigh and ultrahigh frequencies in densely populated areas. In: *Biological Effects and Health Hazards of Microwave Radiation. Proceedings of an International Symposium*, Czerski, P et al, (Eds) Warsaw, 15-18 October 1973, Polish Medical Publishers.

Dutta, SK et al, 1989. Radiofrequency radiation-induced calcium ion efflux enhancement from human and other neuroblastoma cells in culture. *Bioelectromagnetics* 10: 197-202.

Elekes, E, 1996. Effect on the immune system of mice exposed chronically to 50 Hz amplitude-modulated 2.45 GHz microwaves. *Bioelectromagnetics* 17:246-248.

Eltiti S, Wallace D, Ridgewell A, Zougkou K, Russo R, Sepulveda F, Mirshekar-Syahkal D, Rasor P, Deeble R, Fox E. 2007. Does short-term exposure to mobile phone base station signals increase symptoms in individuals who report sensitivity to electromagnetic fields? A double-blind randomized provocation study. *Environ Health Perspect* 115(11): 1603-8.

Eltiti S, Wallace D, Ridgewell A, Zougkou K, Russo R, Sepulveda F, Fox E. 2009. Short-term exposure to mobile phone base station signals does not affect cognitive functioning or physiological measures in individuals who report sensitivity to electromagnetic fields and controls. *Bioelectromagnetics* 30(7):556-63.

Federal Communications Commission, 1997. OET Bulletin 65: 1997-01

Fesenko, EE et al, 1999. Microwaves and cellular immunity. I. Effect of whole body microwave irradiation on tumor necrosis factor production in mouse cells. *Bioelectrochemistry and Bioenergetics* 49 (1): 29-35.

Fragopoulou AF, Koussoulakos SL, Margaritis LH. 2010. Cranial and postcranial skeletal variations induced in mouse embryos by mobile phone radiation. *Pathophysiology*. 17(3): 169-77.

Garaj-Vrhovac, V et al, 1999. Micronucleus assay and lymphocyte mitotic activity in risk assessment of occupational exposure to microwave radiation. *Chemosphere* 39 (13) 2301-2312.

Grundler W, Kaiser F, Keilmann F, Walleczek J. 1992. Mechanisms of electromagnetic interaction with cellular systems. *Naturwissenschaften* 79(12):551-9.

Gul A, Celebi H, Uğraş S.2009. The effects of microwave emitted by cellular phones on ovarian follicles in rats. *Arch Gynecol Obstet*. 280(5):729-33,

Hamblin, D. et al, 2004. Examining the effects of electromagnetic fields emitted by GSM mobile phones on human event-related potentials and performance during an auditory task. *Clinical Neurophysiology* 115:171-178.

Hamnerius, Y, 2000. Microwave exposure from mobile phones and base stations in Sweden. International Conference on Cell Tower Siting, June 7-8, 2000, Sponsored by the University of Vienna & LandSalzburg, Salzburg, Austria.

Heinrich S, Thomas S, Heumann C, von Kries R, Radon K. 2010. Association between exposure to radiofrequency electromagnetic fields assessed by dosimetry and acute symptoms in children and adolescents: a population based cross-sectional study. *Environ Health* 9:75.

Ijollund NH, Bonde JP, Skotte J, 1997 Semen analysis of personnel operating military radar equipment. *Reprod Toxicol* 11(6):897

Hocking, B et al, 1996. Cancer incidence and mortality and proximity to TV towers *Medical Journal of Australia* 165(11-12): 601-605.

Hocking, B et al, 2000. Decreased survival for childhood leukemia in proximity to TV towers. Poster presented at the Annual Scientific Meeting of the Royal Australian College of Physicians in Adelaide, SA, Australia, May 2000.

Huber, R et al, 2002. Electromagnetic fields, such as those from mobile phones alter regional cerebral blood flow and sleep and waking EEG. *J. Sleep Res.* 11: 289-295.

Hutter HP, Moshammer H, Wallner P, Kundi M. 2006. Subjective symptoms, sleeping problems, and cognitive performance in subjects living near mobile phone base stations, *Occup. Environ. Med.* 63. 307–313.

IEEE, 1999. C95: 1-1999(US)

Ilhan A, Gurel A, Armutcu F, Kamisli S, Iraz M, Akyol O, Ozen S. 2004, Ginkgo biloba prevents mobile phone-induced oxidative stress in rat brain. *Clin Chim Acta.* 340(1-2): 153-162.

Ilhan, A et al. 2004. Ginkgo biloba prevents mobile phone-induced oxidative stress in rat brain. *Clinica Chimica Acta* 340, 153-162.

Ivaschuk, OI et al, 1997. Exposure of nerve growth factor-treated PC 12 rat pheochromocytoma cells to a modulated radiofrequency field at 836.55 MHz: effects on c-jun and c-fos expression. *Bioelectromagnetics* 18 (3): 223-229.

Kesari KK, Behari J. 2012 Evidence for mobile phone radiation exposure effects on reproductive pattern of male rats: Role of ROS. *Electromagn Biol Med.* 31(3):213-22,

Khurana VG, Hardell L, Everaert J, Bortkiewicz A, Carlberg M, Ahonen M. 2010. Epidemiological evidence for a health risk from mobile phone base stations. *Int J Occup Environ Health.* 16(3):263-267.

Koivisto, M et al, 2000a. Effects of 902 MHz electromagnetic field emitted by cellular telephones on response times in humans. *Neuroreport* 11: 413-415.

Koivisto, M et al, 2000b. The effects of electromagnetic field emitted by GSM phones on working memory. *Neuroreport* 11:1641-1643.

Kolodynski, AA, & Kolodynska VV, 1996. Motor and psychological functions of school children living in the area of the Skrunda radio location station in Latvia. *Science of the Total Environment* 180:87-93.

Krause, CM et al, 2000. Effects of electromagnetic field emitted by a cellular phone on the EEG during a memory task. *Neuroreport* 11:761-764.

Kues, HA et al, 1992. Increased sensitivity of the non-human primate eye to radiation following ocular drug pretreatment. *Bioelectromagnetics* 13:379-393.

Kumar S, Behari J, Sisodia R. 2012. Impact of Microwave at X-Band in the aetiology of male infertility. *Electromagnetic Biology and Medicine*, 31(3): 223–232. online DOI: 10.3109/15368378.2012.700293.

Kundi M. Hutter HP. 2009. Mobile phone base stations—Effects on wellbeing and health. *Pathophysiology* 16 123–135.

Kwee, S et al, 1997. The biological effects of microwave radiation. Proceedings of the Second World Congress for Electricity and Magnetism in Biology and Medicine, Bologna, Italy, June 1997.

Kwee, S et al, 2001. Changes in cellular proteins due to environmental non-ionizing radiation. I. Heat-shock proteins. *Electro-and Magnetobiology* 20:141-152.

Lai H, & Singh, NP, 1996. Single and double strand DNA breaks in rat brain cells after acute exposure to radiofrequency electromagnetic radiation. *International Journal of Radiation Biology* 69:513-21.

Lass, J et al, 2002. Effects of 7 Hz-modulated 450 MHz electromagnetic radiation on human performance in visual memory tasks. *Int. J. Radiat. Biol.* 73(10): 937-944.

Lebedeva NN et al, 2000. Cellular phone electromagnetic field effects on bioelectric activity of human brain. *Crit Rev Biomed Eng* 28(1-2) 323-337.

Leszczynski, D et al, 2002. Non-thermal activation of the hsp27/p38MAPK stress pathway by mobile phone radiation in the human endothelial cells: Molecular mechanism for cancer- and blood-brain barrier-related effects. *Differentiation* 70: 120-129.

Leszczynski, D et al, 2004. Proteomics analysis of human endothelial cell line EA.hy926 after exposure to GSM 900 radiation. *Short Communication. Proteomics* 4, 1359-1365.

Lu, ST et al, 1999. Ultrawide-band electromagnetic pulses induced hypotension in rats. *Physiology and Behavior*, 67:753-761.

Magras, IN & Zenos, TD, 1997. RF Radiation-induced changes in the prenatal development of mice. *Bioelectromagnetics* 18:455-461.

Mann, K et al, 1996. Effects of pulsed high-frequency electromagnetic fields on human sleep. *Neuropsychobiology* 33:41-47.

Mann, K et al, 1998. Effects of pulsed high-frequency electromagnetic fields on the neuroendocrine system. *Neuroendocrinology* 67: 139-144.

Mantiply, ED et al, 1997. Summary of measured radiofrequency electric and magnetic fields (10 kHz to 30 GHz) in the general and work environment. *Bioelectromagnetics* 18: 563-577.

Markova E, Hillert L, Malmgren L, Persson BRR, Belyaev IY. 2005. Microwaves from GSM mobile telephones affect 53BP1 and γ -H2AX foci in human lymphocytes from hypersensitive and healthy persons. *Environmental Health Perspectives* Vol 113: No. 91 1172-1177

Marinelli, F La Sala D Cicciotti G Cattini L Trimarchi C Putti S Zamparelli A Giuilani L Tomassetti G Cinti C. 2004. Exposure to 900 MHz Electromagnetic Field induces an unbalance between pro-apoptotic and pro-survival signals in T-lymphoblastoid leukemia CCRF-CEM cells. *Journal of Cellular Physiology* 198: 324 – 332.

Mohler E, Frei P, Braun-Fahrlander C, Fröhlich J, Neubauer G, Rösli M; Qualifex Team. 2010. Effects of everyday radiofrequency electromagnetic-field exposure on sleep quality: a cross-sectional study. *Radiat Res* 174(3):347-56.

Oberfeld, G Enrique, NA Manuel P Ceferino M Gomez-Perretta C. 2004. The Microwave Syndrome – Further Aspects of a Spanish Study. 3rd International Workshop on Biological Effects of Electromagnetic Fields. Kos, Greece.

Otitolaju AA, Obe IA, Adewale OA, Otubanjo OA, Osunkalu VO. 2010. Preliminary study on the induction of sperm head abnormalities in mice, *Mus musculus*, exposed to radiofrequency radiations from global system for mobile communication base stations. *Bulletin of Environmental Contamination and Toxicology* 84(1):51-4.

Navakatikian, MA & Tomashevskaya, LA, 1994 Phasic behavioral and endocrine effects of microwaves of nonthermal intensity. In: *Biological Effects of Electric and Magnetic Fields*, Volume 1, Carpenter, DO, (Ed.) Academic Press, Inc., San Diego, CA., pp. 333-342.

Navarro EA, Sequera J, Portoles M, Gomez-Perretta de Mateo C. 2003. The Microwave Syndrome: A Preliminary Study in Spain. *Electromag Biol Med* 22:161-169,

Novoselova, FG et al, 1999. Microwaves and cellular immunity. II Immunostimulating effects of microwaves and naturally occurring antioxidant nutrients. *Bioelectrochemistry and Bioenergetics* 49 (1): 37-41.

Panagopoulos DJ. 2012. Effect of microwave exposure on the ovarian development of *Drosophila melanogaster*. *Cell Biochem Biophys*. 63(2):121-132,.

Paulraj R, Behari J. 2004. Radio frequency radiation effects on protein kinase C activity in rats' brain. *Mutat Res*. 545(1-2):127-130,

Persson, RR et al, 1997. Blood-brain barrier permeability in rats exposed to electromagnetic fields used in wireless communication. *Wireless Networks* 3:455-461.

Paredi P et al, 2001. Local Vasodilator Response to Mobile Phones. *Laryngoscope* 111: 159-162.

Phillips, J et al, 1998. DNA damage in molt-4 lymphoblastoid cells exposed to cellular telephone radiofrequency fields in vitro. *Bioelectrochemistry and Bioenergetics* 45:103-110.

Preece, A et al, 1999. Effect of a 915-MHz simulated mobile phone signal on cognitive function in man. *International Journal of Radiation Biology* 75: 447-456.

Pyrpasopoulou, A et al, 2004. Bone morphogenetic protein expression in newborn rat kidneys after prenatal exposure to radiofrequency radiation. *Bioelectromagnetics* 25: 216-227.

Ray, S & Behari, J, 1990. Physiological changes in rats after exposure to low levels of microwaves. *Radiation Research* 123: 190-202.

Repacholi, M. et al, 1997. Lymphomas in $E\mu$ -Pim1 transgenic mice exposed to pulsed 900 MHz electromagnetic fields. *Radiation Research* 147:31-40.

Richter, E et al, 2000. Cancer in radar technicians exposed to radiofrequency/microwave radiation: sentinel episodes. *International Journal of Occupational Health* 6(3): 187-193.

Riddervold IS, Pedersen GF, Andersen NT, Pedersen AD, Andersen JB, Zachariae R, Mølhave L, Sigsgaard T, Kjaergaard SK. 2008. Cognitive function and symptoms in adults and adolescents in relation to RF radiation from UMTS base stations. *Bioelectromagnetics* 29(4):257-67.

Sage Associates, 2004. An Overview of Low-Intensity Radiofrequency/Microwave Radiation Studies Relevant to Wireless Communications and Data. *Bioelectromagnetics Society Annual Meeting*, Washington DC, June 2004.

Sage Associates, 2004. Epidemiology for Decisionmakers: A Visual Guide to Residential and Occupational EMF Epidemiological Results on Leukemia 1979-2004. International Conference on Leukemia, London, September 2004. Children with Leukemia Trust (UK Registered Charity No. 298405).

Sage Associates, 2000. An overview of radiofrequency/microwave radiation studies relevant to wireless communications and data. International Conference on Cell Tower Siting, Salzburg, Austria, Land Salzburg-Landessanitätsdirektion – Umweltmedizin, Federal State of Salzburg Public Health Department, Environmental Health Unit, June 7-8, 2000.

Salama N, Kishimoto T, Kanayama HO. 2010. Effects of exposure to a mobile phone on testicular function and structure in adult rabbit. *Int J Androl.* 33(1):88-94.

Salford, LG et al. 1994. Permeability of the blood brain barrier induced by 915 MHz electromagnetic radiation, continuous wave and modulated at 8, 16, 50 and 200 Hz. *Microscopy Research and Technique* 27:535-542.

Salford, LG et al, 2003. Nerve cell damage in mammalian brain after exposure to microwaves from GSM mobile phones. *Environmental Health Perspectives Online* January 29.

Sandstrom M et al, 2001. Mobile phone use and subjective symptoms. Comparison of symptoms experienced by users of analogue and digital mobile phones. *Occup Med* 51(1): 25-35.

Santini R et al, 2001. Symptoms rapportes par des utilisateurs de telephones mobiles cellulaires. *Path Biol* 49:222-226.

Sarimov, R., Malmgren, L.O.G., Markova, E., Persson, B.R.R., Belyaev, I.Y. 2004. Nonthermal GSM microwaves affect chromatin conformation in human lymphocytes similar to heat shock. *IEEE Trans Plasma Sci* 32:1600-1608,

Schirmacher, A et al, 2000. Electromagnetic fields (1.8 GHz) increase the permeability of sucrose of the blood-brain barrier in vitro. *Bioelectromagnetics* 21:338-345.

Schmidt M Murbach M Inelustenberger C Maire M Kuster N Achermann P. s2012. Sleep EEG alterations: effects of pulsed magnetic fields versus pulse-modulated radio frequency electromagnetic fields. *J. Sleep Research, European Sleep Research Society* DOI: 10.1111/j.1365-2869.2012.01025.x.

Schwartz, JL et al, 1990. Exposure of frog hearts to CW or amplitude-modulated VHF fields: selective efflux of calcium ions at 16Hz. *Bioelectromagnetics* 11(4): 349-358.

Seaman, RL et al, 1999. Hyperactivity caused by nitric oxide synthase inhibitor is countered by ultra-wide band pulses. *Bioelectromagnetics* 20: 431-439.

Somogyi, Z et al, 1991. Effects of modulated and continuous microwave irradiation on the morphology and cell surface negative charge of 3T3 fibroblasts. *Scanning Microsc* 5(4): 1145-1155.

Somogyi, Z et al, 1993. Effects of modulated and continuous microwave irradiation on pyroantimonate precipitable calcium content in junctional complex of mouse small intestine. *Scanning Microsc* 7(4): 1255-1261.

Stagg RB et al, 1997. DNA synthesis and cell proliferation in C6 glioma and primary glial cells exposed to 836.55 MHz modulated radiofrequency field. *Bioelectromagnetics* 18(3):230-236.

Stang A et al, 2001. The possible role of radiofrequency radiation in the development of uveal melanoma. *Epidemiology* 12(1):7-12.

Stankiewicz W, Dąbrowski MP, Kubacki R, Sobiczewska E, Szmigielski S. 2006. Immunotropic Influence of 900 MHz Microwave GSM Signal on Human Blood Immune Cells Activated in Vitro. *Electromagnetic Biology and Medicine* 25(1) 45-51.

Stark KD et al, 1997. Absence of chronic effect of exposure to short-wave radio broadcast signal on salivary melatonin concentrations in dairy cattle. *J Pineal Res* 22(4):171:176.

Sun W, Shen X, Lu D, Fu Y, Chiang H. 2012. A 1.8-GHz radiofrequency radiation induces EGF receptor clustering and phosphorylation in cultured human amniotic (FL) cells. *Int J Radiat Biol* 88(3):239-44.

Szmigielski, S et al, 1982. Accelerated development of spontaneous and benzyrene-induced skin cancer in mice exposed to 2350 MHz microwave radiation. *Bioelectromagnetics* 3: 179-192.

Tattersall, JE et al, 2001. Effects of low intensity radiofrequency electromagnetic fields on electrical activity in rat hippocampal slices. *Brain Res* 904(1): 43-53.

Thomas S, Kühnlein A, Heinrich S, Praml G, Nowak D, von Kries R, Radon K. 2008. Personal exposure to mobile phone frequencies and well-being in adults: a cross-sectional study based on dosimetry. *Bioelectromagnetics* 29:463-470.

Thomas S, Heinrich S, von Kries R, Radon K. 2010. Exposure to radio-frequency electromagnetic fields and behavioural problems in Bavarian children and adolescents. *Eur J Epidemiol* 25(2):135-41.

TNO Physics and Electronics Laboratory, The Netherlands. 2003. Effects of Global Communication System radio-frequency fields on well-being and cognitive functions of human beings with and without subjective complaints. Netherlands Organization for Applied Scientific Research 1-63.

Trosic, I et al, 2002. Micronucleus induction after whole-body microwave irradiation of rats. *Mutation Research* 521: 73-79.

Velizarov, S et al, 1999. The effects of radiofrequency fields on cell proliferation are non-thermal. *Bioelectrochemistry and Bioenergetics* 48: 177-180.

Veyret, B et al, 1991. Antibody responses of mice exposed to low-power microwaves under combined, pulse and amplitude modulation. *Bioelectromagnetics* 12: 47-56.

Weisbrot, D et al, 2003. Effects of mobile phone radiation on reproduction and development in *Drosophila melanogaster*. *Journal of Cellular Biochemistry* 89: 48-55.

Wolke, S et al, 1996. Calcium homeostasis of isolated heart muscle cells exposed to pulsed high-frequency electromagnetic fields. *Bioelectromagnetics* 17(2): 144-153.

Yan JG, Agresti M, Bruce T, Yan YH, Granlund A, Matloub HS. 2007. Effects of cellular phone emissions on sperm motility in rats. *Fertility and Sterility* 88(4):957-64.

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Reported Biological Effects from Radiofrequency Radiation at Low-Intensity Exposure
(Cell Tower, Wi-Fi, Wireless Laptop and 'Smart' Meter RF Intensities)

CARPENTER DEPO
EXHIBIT 5

Power Density (Microwatts/centimeter² - uW/cm²)		Reference
As low as (10 ⁻¹³) or 100 femtowatts/cm ²	Super-low intensity RFR effects at MW resonant frequencies resulted in changes in genes; problems with chromatin conformation (DNA)	Belyaev, 1997
5 picowatts/cm ² (10 ⁻¹²)	Changed growth rates in yeast cells	Grundler, 1992
0.1 nanowatt/cm ² (10 ⁻¹⁰) or 100 picowatts/cm ²	Super-low intensity RFR effects at MW resonant frequencies resulted in changes in genes; problems with chromatin condensation (DNA) intensities comparable to base stations	Belyaev, 1997
0.00034 uW/cm ²	Chronic exposure to mobile phone pulsed RF significantly reduced sperm count,	Behari, 2006
0.0005 uW/cm ²	RFR decreased cell proliferation at 960 MHz GSM 217 Hz for 30-min exposure	Velizarov, 1999
0.0006 - 0.0128 uW/cm ²	Fatigue, depressive tendency, sleeping disorders, concentration difficulties, cardio-vascular problems reported with exposure to GSM 900/1800 MHz cell phone signal at base station level exposures.	Oberfeld, 2004
0.0009 uW/cm ²	RFR induced 10%-40% increase in DNA synthesis in glioma cells (brain)	Stagg, 1997
0.003 - 0.02 uW/cm ²	In children and adolescents (8-17 yrs) short-term exposure caused headache, irritation, concentration difficulties in school.	Heinrich, 2010
0.003 to 0.05 uW/cm ²	In children and adolescents (8-17 yrs) short-term exposure caused conduct problems in school (behavioral problems)	Thomas, 2010
0.005 uW/cm ²	In adults (30-60 yrs) chronic exposure caused sleep disturbances, (but not significantly increased across the entire population)	Mohler, 2010
0.005 - 0.04 uW/cm ²	Adults exposed to short-term cell phone radiation reported headaches, concentration difficulties (differences not significant, but elevated)	Thomas, 2008
0.006 - 0.01 uW/cm ²	Chronic exposure to base station RF (whole-body) in humans showed increased stress hormones; dopamine levels substantially decreased; higher levels of adrenaline and nor-adrenaline; dose-response seen; produced chronic physiological stress in cells even after 1.5 years.	Buchner, 2012
0.01 - 0.11 uW/cm ²	RFR from cell towers caused fatigue, headaches, sleeping problems	Navarro, 2003

Stress proteins, HSP, disrupted immune function	Brain tumors and blood-brain barrier
Reproduction/fertility effects	Sleep, neuron firing rate, EEG, memory, learning, behavior
Oxidative damage/ROS/DNA damage/DNA repair failure	Cancer (other than brain), cell proliferation
Disrupted calcium metabolism	Cardiac, heart, muscle, blood-pressure, vascular effects

Reported Biological Effects from Radiofrequency Radiation at Low-Intensity Exposure (Cell Tower, Wi-Fi, Wireless Laptop and 'Smart' Meter RF Intensities)

Power Density (Microwatts/centimeter ² - uW/cm ²)		Reference
0.01 - 0.05 uW/cm ²	Adults (18-91 yrs) with short-term exposure to GSM cell phone radiation reported headache, neurological problems, sleep and concentration problems.	Hutter, 2006
0.005 - 0.04 uW/cm ²	Adults exposed to short-term cell phone radiation reported headaches, concentration difficulties (differences not significant, but elevated)	Thomas, 2008
0.015 - 0.21 uW/cm ²	Adults exposed to short-term GSM 900 radiation reported changes in mental state (e.g., calmness) but limitations of study on language descriptors prevented refined word choices (stupified, zoned-out)	Augner, 2009
0.05 - 0.1 uW/cm ²	RFR linked to adverse neurological, cardio symptoms and cancer risk	Khurana, 2010
0.05 - 0.1 uW/cm ²	RFR related to headache, concentration and sleeping problems, fatigue	Kundi, 2009
0.07 - 0.1 uW/cm ²	Sperm head abnormalities in mice exposed for 6-months to base station level RF/MW. Sperm head abnormalities occurred in 39% to 46% exposed mice (only 2% in controls) abnormalities was also found to be dose dependent. The implications of the pin-head and banana-shaped sperm head. The occurrence of sperm head observed increase occurrence of sperm head abnormalities on the reproductive health of humans living in close proximity to GSM base stations were discussed."	Otitoloju, 2010
0.38 uW/cm ²	RFR affected calcium metabolism in heart cells	Schwartz, 1990
0.8 - 10 uW/cm ²	RFR caused emotional behavior changes, free-radical damage by super-weak MWs	Akoev, 2002
0.13 uW/cm ²	RFR from 3G cell towers decreased cognition, well-being	Zwamborn, 2003
0.16 uW/cm ²	Motor function, memory and attention of school children affected (Latvia)	Kolodynski, 1996
0.168 - 1.053 uW/cm ²	Irreversible infertility in mice after 5 generations of exposure to RFR from an 'antenna park'	Magras & Zenos, 1997
0.2 - 8 uW/cm ²	RFR caused a two-fold increase in leukemia in children	Hocking, 1996
0.2 - 8 uW/cm ²	RFR decreased survival in children with leukemia	Hocking, 2000
0.21 - 1.28 uW/cm ²	Adolescents and adults exposed only 45 min to UMTS cell phone radiation reported increases In headaches.	Riddervold, 2008

Stress proteins, HSP, disrupted immune function	Brain tumors and blood-brain barrier
Reproduction/fertility effects	Sleep, neuron firing rate, EEG, memory, learning, behavior
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Reported Biological Effects from Radiofrequency Radiation at Low-Intensity Exposure (Cell Tower, Wi-Fi, Wireless Laptop and 'Smart' Meter RF Intensities)

Power Density (Microwatts/centimeter ² - uW/cm ²)		Reference
0.5 uW/cm ²	Significant degeneration of seminiferous epithelium in mice at 2.45 GHz, 30-40 min.	Saunders, 1981
0.5 - 1.0 uW/cm ²	Wi-Fi level laptop exposure for 4-hr resulted in decrease in sperm viability, DNA fragmentation with sperm samples placed in petri dishes under a laptop connected via WI-FI to the internet.	Avendano, 2012
1.0 uW/cm ²	RFR induced pathological leakage of the blood-brain barrier	Persson, 1997
1.0 uW/cm ²	RFR caused significant effect on immune function in mice	Fesenko, 1999
1.0 uW/cm ²	RFR affected function of the immune system	Novoselova, 1999
1.0 uW/cm ²	Short-term (50 min) exposure in electrosensitive patients, caused loss of well-being after GSM and especially UMTS cell phone radiation exposure	Eltiti, 2007
1.3 - 5.7 uW/cm ²	RFR associated with a doubling of leukemia in adults	Dolk, 1997
1.25 uW/cm ²	RFR exposure affected kidney development in rats (in-utero exposure)	Pyrpasopoulou, 2004
1.5 uW/cm ²	RFR reduced memory function in rats	Nittby, 2007
2 uW/cm ²	RFR induced double-strand DNA damage in rat brain cells	Kesari, 2008
2.5 uW/cm ²	RFR affected calcium concentrations in heart muscle cells	Wolke, 1996
2 - 4 uW/cm ²	Altered cell membranes; acetylcholine-induced ion channel disruption	D'Inzeo, 1988
4 uW/cm ²	RFR caused changes in hippocampus (brain memory and learning)	Tattersall, 2001
4 - 15 uW/cm ²	Memory impairment, slowed motor skills and retarded learning in children	Chiang, 1989
5 uW/cm ²	RFR caused drop in NK lymphocytes (immune function decreased)	Boscolo, 2001
5.25 uW/cm ²	20 minutes of RFR at cell tower frequencies induced cell stress response	Kwee, 2001
5 - 10 uW/cm ²	RFR caused impaired nervous system activity	Dumansky, 1974
6 uW/cm ²	RFR induced DNA damage in cells	Phillips, 1998

Stress proteins, HSP, disrupted immune function	Brain tumors and blood-brain barrier
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Reported Biological Effects from Radiofrequency Radiation at Low-Intensity Exposure (Cell Tower, Wi-Fi, Wireless Laptop and 'Smart' Meter RF Intensities)

Power Density (Microwatts/centimeter ² - uW/cm ²)		Reference
8.75 uW/cm ²	RFR at 900 MHz for 2-12 hours caused DNA breaks in leukemia cells	Marinelli, 2004
10 uW/cm ²	Changes in behavior (avoidance) after 0.5 hour exposure to pulsed RFR	Navakatikian, 1994
10 - 100 uW/cm ²	Increased risk in radar operators of cancer; very short latency period; dose response to exposure level of RFR reported.	Richter, 2000
12.5 uW/cm ²	RFR caused calcium efflux in cells - can affect many critical cell functions	Dutta, 1989
13.5 uW/cm ²	RFR affected human lymphocytes - induced stress response in cells	Sarimov, 2004
14.75 uW/cm ²	RFR increased biomarker for cell division in glioma brain tumor cells	Stagg, 1997
20 uW/cm ²	Increase in serum cortisol (a stress hormone)	Mann, 1998
28.2 uW/cm ²	RFR increased free radical production in rat cells	Yurekli, 2006
37.5 uW/cm ²	Immune system effects - elevation of PFC count (antibody producing cells)	Veyret, 1991
45 uW/cm ²	Pulsed RFR affected serum testosterone levels in mice	Forgacs, 2006
50 uW/cm ²	Cell phone RFR caused a pathological leakage of the blood-brain barrier in 1 hour	Salford, 2003
50 uW/cm ²	An 18% reduction in REM sleep (important to memory and learning functions)	Mann, 1996
60 uW/cm ²	RFR caused structural changes in cells of mouse embryos	Somozy, 1991
60 uW/cm ²	Pulsed RFR affected immune function in white blood cells	Stankiewicz, 2006
60 uW/cm ²	Cortex of the brain was activated by 15 minutes of 902 MHz cell phone	Lebedeva, 2000
65 uW/cm ²	RFR affected genes related to cancer	Ivaschuk, 1999
92.5 uW/cm ²	RFR caused genetic changes in human white blood cells	Belyaev, 2005
100 uW/cm ²	Changes in immune function	Elekes, 1996
100 uW/cm ²	A 24.3% drop in testosterone after 6 hours of CW RFR exposure	Navakatikian, 1994

Stress proteins, HSP, disrupted immune function	Brain tumors and blood-brain barrier
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Power Density (Microwatts/centimeter ² - uW/cm ²)		Reference
120 uW/cm ²	A pathological leakage in the blood-brain barrier with 915 MHz cell RF	Salford, 1994
500 uW/cm ²	Intestinal epithelial cells exposed to 2.45 GHz pulsed at 16 Hz showed changes in intercellular calcium.	Somozy, 1993
500 uW/cm ²	A 24.6% drop in testosterone and 23.2% drop in insulin after 12 hrs of pulsed RFR exposure.	Navakatikian, 1994

STANDARDS		
530 - 600 uW/cm ²	Limit for uncontrolled public exposure to 800-900 MHz	ANSI/IEEE and FCC
1000 uW/cm ²	PCS STANDARD for public exposure (as of September 1, 1997)	FCC, 1996
5000 uW/cm ²	PCS STANDARD for occupational exposure (as of September 1, 1997)	FCC, 1996
BACKGROUND LEVELS		
0.003 uW/cm ²	Background RF levels in US cities and suburbs in the 1990s	Mantiply, 1997
0.05 uW/cm ²	Median ambient power density in cities in Sweden (30-2000 MHz)	Hamnerius, 2000
0.1 - 10 uW/cm ²	Ambient power density within 100-200' of cell site in US (data from 2000)	Sage, 2000

Stress proteins, HSP, disrupted immune function	Brain tumors and blood-brain barrier
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SAR (Watts/Kilogram)		Reference
0.000064 - 0.000078 W/Kg	Well-being and cognitive function affected in humans exposed to GSM-UMTS cell phone frequencies; RF levels similar near cell sites	TNO Physics and
0.00015 - 0.003 W/Kg	Calcium ion movement in isolated frog heart tissue is increased 18% ($P < .01$) and by 21% ($P < .05$) by weak RF field modulated at 16 Hz	Schwartz, 1990
0.000021 - 0.0021 W/Kg	Changes in cell cycle; cell proliferation (960 MHz GSM mobile phone)	Kwee, 1997
0.0003 - 0.06 W/Kg	Neurobehavioral disorders in offspring of pregnant mice exposed in utero to cell phones - dose-response impaired glutamatergic synaptic transmission onto layer V pyramidal neurons of the prefrontal cortex. Hyperactivity and impaired memory function in offspring. Altered brain development.	Aldad, 2012
0.0009 W/Kg	Changes in brain glial cells with TDMA 836.55 MHz frequency	Stagg, 1997
0.0016 - 0.0044 W/Kg	Very low power 700 MHz CW affects excitability of hippocampus tissue, consistent with reported behavioral changes.	Tattersall, 2001
0.0021 W/Kg	Heat shock protein HSP 70 is activated by very low intensity microwave exposure in human epithelial amnion cells	Kwee, 2001
0.0024 - 0.024 W/Kg	Digital cell phone RFR at very low intensities causes DNA damage in human cells; both DNA damage and impairment of DNA is reported	Phillips, 1998
0.0027 W/Kg	Changes in active avoidance conditioned behavioral effect is seen after one-half hour of pulsed radiofrequency radiation	Navakatikian, 1994
0.0035 W/Kg	900 MHz cell phone signal induces DNA breaks and early activation of p53 gene; short exposure of 2-12 hours leads cells to acquire greater survival chance - linked to tumor aggressiveness.	Marinelli, 2004
0.0095 W/Kg	MW modulated at 7 Hz produces more errors in short-term memory function on complex tasks (can affect cognitive processes such as attention and memory)	Lass, 2002
0.001 W/Kg	750 MHz continuous wave (CW) RFR exposure caused increase in heat shock protein (stress proteins). Equivalent to what would be induced by 3 degree C. heating of tissue (but no heating occurred)	De Pomerai, 2000

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SAR (Watts/Kilogram)		Reference
0.001 W/Kg	Statistically significant change in intracellular calcium concentration in heart muscle cells exposed to RFR (900 MHz/50 Hz modulation)	Wolke, 1996
0.0021 W/Kg	A significant change in cell proliferation not attributable to thermal heating. RFR induces non-thermal stress proteins (960 MHz GSM)	Velizarov, 1999
0.004 - 0.008 W/Kg	915 MHz cell phone RFR caused pathological leakage of blood-brain barrier. Worst at lower SAR levels and worse with CW compared to Frequency of pathological changes was 35% in rats exposed to pulsed radiation at 50% to continuous wave RFR. Effects observed at a specific absorption (SA) of > 1.5 joules/Kg in human tissues	Persson, 1997
0.0059 W/Kg	Cell phone RFR induces glioma (brain cancer) cells to significantly increase thymidine uptake, which may be indication of more cell division	Stagg, 1997
0.014 W/Kg	Sperm damage from oxidative stress and lowered melatonin levels resulted from 2-hr per day/45 days exposure to 10 GHz.	Kumar, 2012
0.015 W/Kg	Immune system effects - elevation of PFC count (antibody-producing cells)	Veyret, 1991
0.02 W/Kg	A single, 2-hr exposure to GSM cell phone radiation results in serious neuron damage (brain cell damage) and death in cortex, hippocampus, and basal ganglia of brain- even 50+ days later blood-brain barrier is still leaking albumin (P<.002) following only one cell phone exposure	Salford, 2003
0.026 W/Kg	Activity of c-jun (oncogene or cancer gene) was altered in cells after 20 minutes exposure to cell phone digital TDMA signal	Ivaschuk, 1997
0.0317 W/Kg	Decrease in eating and drinking behavior	Ray, 1990
0.037 W/Kg	Hyperactivity caused by nitric oxide synthase inhibitor is countered by exposure to ultra-wide band pulses (600/sec) for 30 min	Seaman, 1999
0.037 - 0.040 W/Kg	A 1-hr cell phone exposure causes chromatin condensation; impaired DNA repair mechanisms; last 3 days (longer than stress response) the effect reaches saturation in only one hour of exposure; electro- sensitive (ES) people have different response in formation of DNA repair foci, compared to healthy individuals; effects depend on carrier frequency (915 MHz = 0.037 W/Kg but 1947 MHz = 0.040 W/Kg)	Belyaev, 2008

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SAR (Watts/Kilogram)		Reference
0.05 W/Kg	Significant increase in firing rate of neurons (350%) with pulsed 900 MHz cell phone radiation exposure (but not with CW) in avian brain cells	Beason, 2002
0.09 W/Kg	900 MHz study of mice for 7 days, 12-hr per day (whole-body) resulted in significant effect on mitochondria and genome stability	Aitken, 2005
0.091 W/Kg	Wireless internet 2400 MHz, 24-hrs per day/20 weeks increased DNA damage and reduced DNA repair; levels below 802.11 g Authors say "findings raise questions about safety of radiofrequency exposure from Wi-Fi internet access devices for growing organisms of reproductive age, with a potential effect on fertility and integrity of germ cells" (male germ cells are the reproductive cells=sperm)	Atasoy, 2012
0.11 W/Kg	Increased cell death (apoptosis) and DNA fragmentation at 2.45 GHz for 35 days exposure (chronic exposure study)	Kesari, 2010
0.121 W/Kg	Cardiovascular system shows significant decrease in arterial blood pressure (hypotension) after exposure to ultra-wide band pulses	Lu, 1999
0.13 - 1.4 W/Kg	Lymphoma cancer rate doubled with two 1/2-hr exposures per day of cell phone radiation for 18 months (pulsed 900 MHz cell signal)	Repacholi, 1997
0.14 W/Kg	Elevation of immune response to RFR exposure	Elekes, 1996
0.141 W/Kg	Structural changes in testes - smaller diameter of seminiferous	Dasdag, 1999
0.15 - 0.4 W/Kg	Statistically significant increase in malignant tumors in rats chronically exposed to RFR	Chou, 1992
0.26 W/Kg	Harmful effects to the eye/certain drugs sensitize the eye to RFR	Kues, 1992
0.28 - 1.33 W/Kg	Significant increase in reported headaches with increasing use of hand-held cell phone use (maximum tested was 60 min per day)	Chia, 2000
0.3 - 0.44 W/Kg	Cell phone use results in changes in cognitive thinking/mental tasks related to memory retrieval	Krause, 2000
0.3 - 0.44 W/Kg	Attention function of brain and brain responses are speeded up	Preece, 1999
0.3 - 0.46 W/Kg	Cell phone RFR doubles pathological leakage of blood-brain barrier permeability at two days (P=.002) and triples permeability at four days (P=.001) at 1800 MHz GSM cell phone radiation	Schirmacher, 2000

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SAR (Watts/Kilogram)		Reference
0.43 W/Kg	Significant decrease in sperm mobility; drop in sperm concentration; and decrease in seminiferous tubules at 800 MHz, 8-hr/day, 12 weeks, with mobile phone radiation level on STANDBY ONLY (in rabbits)	Salama, 2008
0.5 W/Kg	900 MHz pulsed RF affects firing rate of neurons (<i>Lymnea stagnalis</i>) but continuous wave had no effect	Bolshakov, 1992
0.58 - 0.75 W/Kg	Decrease in brain tumors after chronic exposure to RFR at 836 MHz	Adey, 1999
0.6 - 0.9 W/Kg	Mouse embryos develop fragile cranial bones from in utero 900 MHz The authors say "(O)ur results clearly show that even modest exposure (e.g., 6 min daily for 21 days" is sufficient to interfere with the normal mouse developmental process"	Fragopoulou, 2009
0.6 and 1.2 W/Kg	Increase in DNA single and double-strand DNA breaks in rat brain cells with exposure to 2450 MHz RFR	Lai & Singh, 1996
0.795 W/Kg	GSM 900 MHz, 217 Hz significantly decreases ovarian development and size of ovaries, due to DNA damage and premature cell death of nurse cells and follicles in ovaries (that nourish egg cells)	Panagopoulous, 2012
0.87 W/Kg	Altered human mental performance after exposure to GSM cell phone radiation (900 MHz TDMA digital cell phone signal)	Hamblin, 2004
0.87 W/Kg	Change in human brainwaves; decrease in EEG potential and statistically significant change in alpha (8-13 Hz) and beta (13-22 Hz) brainwave activity in humans at 900 MHz; exposures 6/min per day for 21 days (chronic exposure)	D'Costa, 2003
0.9 W/Kg	Decreased sperm count and more sperm cell death (apoptosis) after 35 days exposure, 2-hr per day	Kesari, 2012
< 1.0 W/Kg	Rats exposed to mobile phone radiation on STANDBY ONLY for 11-hr 45-min plus 15-min TRANSMIT mode; 2 times per day for 21 days showed decreased number of ovarian follicles in pups born to these pregnant rats. The authors conclude "the decreased number of follicles in pups exposed to mobile phone microwaves suggest that intrauterine exposure has toxic effects on ovaries."	Gul, 2009
0.4 - 1.0 W/Kg	One 6-hr exposure to 1800 MHz cell phone radiation in human sperm cells caused a significant dose response and reduced sperm motility and viability; reactive oxygen species levels were significantly increased after exposure to 1.0 W/Kg; study confirms detrimental effects of RF/MW to human sperm. The authors conclude "(T)hese findings have clear implications for the safety of extensive mobile phone use by males of reproductive age, potentially affecting both their fertility and the health and wellbeing of their offspring."	De Iuliis, 2009

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SAR (Watts/Kilogram)		Reference
1.0 W/Kg	Human semen degraded by exposure to cell phone frequency RF increased free-radical damage.	De Iuliis, 2009
1.0 W/Kg	Motility, sperm count, sperm morphology, and viability reduced in active cell phone users (human males) in dose-dependent manner.	Agarwal, 2008
1.0 W/Kg	GSM cell phone use modulates brain wave oscillations and sleep EEG	Huber, 2002
1.0 W/Kg	Cell phone RFR during waking hours affects brain wave activity. (EEG patterns) during subsequent sleep	Achermann, 2000
1.0 W/Kg	Cell phone use causes nitric oxide (NO) nasal vasodilation (swelling inside nasal passage) on side of head phone use	Paredi, 2001
1.0 W/Kg	Four-fold increase in eye cancer (uveal melanoma) in cell phone users	Stang, 2001
1.0 W/Kg	Increase in headache, fatigue and heating behind ear in cell phone users	Sandstrom, 2001
1.0 W/Kg	Significant increase in concentration difficulties using 1800 MHz cell phone compared to 900 MHz cell phone	Santini, 2001
1.0 W/Kg	Sleep patterns and brain wave activity are changed with 900 MHz cell phone radiation exposure during sleep	Borbely, 1999
1.4 W/Kg	GSM cell phone exposure induced heat shock protein HSP 70 by 360% (stress response) and phosphorylation of ELK-1 by 390%	Weisbrot, 2003
1.46 W/Kg	850 MHz cell phone radiation decreases sperm motility, viability is significantly decreased; increased oxidative damage (free-radicals) significantly decreased; increased oxidative damage (free-radicals)	Agarwal, 2009
1.48 W/Kg	A significant decrease in protein kinase C activity at 112 MHz with 2-hr per day for 35 days; hippocampus is site, consistent with reports that RFR negatively affects learning and memory functions	Paulraj, 2004
1.0 - 2.0 W/Kg	Significant elevation in micronuclei in peripheral blood cells at 2450 MHz (8 treatments of 2-hr each)	Trosic, 2002
1.5 W/Kg	GSM cell phone exposure affected gene expression levels in tumor suppressor p53-deficient embryonic stem cells; and significantly increased HSP 70 heat shock protein production	Czyz, 2004

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SAR (Watts/Kilogram)		Reference
1.8 W/Kg	Whole-body exposure to RF cell phone radiation of 900-1800 MHz 1 cm from head of rats caused high incidence of sperm cell death; deformation of sperm cells; prominent clumping together of sperm cells into "grass bundle shapes" that are unable to separate/swim. Sperm cells unable to swim and fertilize in normal manner.	Yan, 2007
2.0 W/Kg	GSM cell phone exposure of 1-hr activated heat shock protein HSP 27 (stress response) and P38 MAPK (mutagen-activated protein kinase) that authors say facilitates brain cancer and increased blood-brain barrier permeability, allowing toxins to cross BBB into brain	Leszczynski, 2002
2 W/Kg	900 MHz cell phone exposure caused brain cell oxidative damage by increasing levels of NO, MDA, XO and ADA in brain cells; caused statistically significant increase in 'dark neurons' or damaged brain cells in cortex, hippocampus and basal ganglia with a 1-hr exposure for 7 consecutive days	Ilhan, 2004
2.6 W/Kg	900 MHz cell phone exposure for 1-hr significantly altered protein expression levels in 38 proteins following irradiation; activates P38 MAP kinase stress signalling pathway and leads to changes in cell size and shape (shrinking and rounding up) and to activation of HSP 27, a stress protein (heat shock protein)	Leszczynski, 2004
2.0 - 3.0 W/Kg	RFR accelerated development of both skin and breast tumors	Szmigielski, 1982
2 W/Kg	Pulse-modulated RFR and MF affect brain physiology (sleep study)	Schmidt, 2012

STANDARDS		
0.08 W/Kg	IEEE Standard uncontrolled public environment (whole body)	IEEE
0.4 W/Kg	IEEE Standard controlled occupational environment (whole body)	IEEE
1.6 W/Kg	FCC (IEEE) SAR limit for 1 gram of tissue in a partial body exposure	FCC, 1996
2 W/Kg	ICNIRP SAR limit for 10 grams of tissue	ICNIRP, 1996

Stress proteins, HSP, disrupted immune function	Brain tumors and blood-brain barrier
Reproduction/fertility effects	Sleep, neuron firing rate, EEG, memory, learning, behavior
Oxidative damage/ROS/DNA damage/DNA repair failure	Cancer (other than brain), cell proliferation
Disrupted calcium metabolism	Cardiac, heart muscle, blood-pressure, vascular effects

**DAVID CARPENTER
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**CARPENTER DEPO
EXHIBIT 6**

Reference List

**Reported Biological Effects from Radiofrequency Radiation (RFR)
at Low-Intensity Exposure Levels
(Cell Tower, WI-FI, Wireless Laptop,
Wireless Utility Meters 'smart meters')**

Prepared November 22, 2012 by:
Cindy Sage, MA, Sage Associates

Acherman P et al, 2000. Exposure to pulsed high-frequency electromagnetic field during waking affects human sleep EEG. *NeuroReport* 11(15):3321-3325.

Adey,WR et al, 1999. Incidence of spontaneous and nitrosourea-induced primary tumors of the central nervous system in Fischer 344 rats chronically exposed to modulated microwaves. *Radiation Research* 152: 293-302.

Agarwal A, Deepinder F, Sharma RK, Ranga G, Li J.2008. Effect of cell phone usage on semen analysis in men attending infertility clinic: an observational study. *Fertil Steril.* 89(1): 124-8.

Agarwal A, Desai NR, Makker K, Varghese A, Mouradi R, Sabanegh E, Sharma R. 2009. Effects of radiofrequency electromagnetic waves (RF-EMW) from cellular phones on human ejaculated semen: an in vitro pilot study. *Fertil Steril.* 92(4) 1318-1325.

Aitken RJ, Bennetts LE, Sawyer D, Wiklendt AM, King BV. 2005 Impact of radio frequency electromagnetic radiation on DNA integrity in the male germline 28:171-179.

Akoev, IG et al, 2002. Enzymatic activity of some tissues and blood serum from animals and humans exposed to microwaves and hypothesis on the possible role of free radical processes in the nonlinear effects and modification of emotional behavior of animals. *Radiats Biol Radioecol*, 42(3):32-330.

Atasoy HI, Gunal MY, Atasoy P, Elgun S, Bugdayci G. 2012 Immunohistopathologic demonstration of deleterious effects on growing rat testes of radiofrequency waves emitted from conventional Wi-Fi devices. *J Pediatr Urol.* [Epub ahead of print]

Avendano C, Mata A, Sanchez Sarmiento CA, Doncei GF. 2012. Use of laptop computers connected to internet through Wi-Fi decreases human sperm motility and increases sperm DNA fragmentation. *Fertility and Sterility.* American Society for Reproductive Medicine, Published by Elsevier Inc. doi:10.1016/j.fertnstert.2011.10.012.

DAVID CARPENTER
EXHIBIT B

Beason, RC & Semm, P, 2002. Responses of neurons to an amplitude modulated microwave stimulus. *Neuroscience Letters* 333:175-178.

Behari J, Kesari KK 2006. Effects of microwave radiations on reproductive system of male rats. *Embryo Talk* 1 (Suppl.1):81-5.

Belokrinitsky, VS, 1982,. Destructive and reparative processes in hippocampus with long-term exposure to nonionizing radiation. In: U.S.S.R. Report, Effects of Nonionizing Microwave Radiation, No. 7, JPRS 81865, pp. 15-20.

Belyaev IY, Alipov YD, Harms-Ringdahl M. 1997. Effects of zero magnetic field on the conformation of chromatin in human cells. *Biochim Biophys Acta* 1336(3):465-473.

Belyaev IY, Hillert L, Protopopova M, Tamm C, Malmgren LO, Persson BR, Selivanova G, Harms-Ringdahl M. 2005. 915 MHz microwaves and 50 Hz magnetic field affect chromatin conformation and 53BP1 foci in human lymphocytes from hypersensitive and healthy persons. *Bioelectromagnetics*. 26(3):173-184.

Belyaev IY, Markova E, Hillert L, Malmgren LOG, Persson BRR. 2009. Microwaves from UMTS/GSM mobile phones induce long-lasting inhibition of 53BP1/γ-H2AX DNA repair foci in human lymphocytes. *Bioelectromagnetics* 30(2):129-41.

Bolshakov, MA & Alekseev, SI, 1992. Bursting responses of Lymnea neurons to microwave radiation. *Bioelectromagnetics* 13(2): 119-129.

Borbely, AA et al, 1999. Pulsed high-frequency electromagnetic field affects human sleep and sleep electroencephalogram. *Neuroscience Letters* 275(3): 207-210.

Boscolo et al, 2001. Effects of electromagnetic fields produced by radiotelevision broadcasting stations on the immune system of women. *Sci Total Environ* 273(1-3):1-10.

Buchner K, Eger H., 2011. Changes of Clinically Important Neurotransmitters under the Influence of Modulated RF Fields—A Long-term Study under Real-life Conditions *Umwelt-Medizin-Gesellschaft* 24(1): 44-57. Original study in German.

Chia SE et al, 2000. Prevalence of headache among handheld cellular telephone users in Singapore: A Community Study. *Environmental Health Perspectives* 108(11):1059-1062.

Chiang, H et al, 1989. Health effects of environmental electromagnetic fields. *Journal of Bioelectricity* 8: 127-131.

Chou, CK et al, 1992. Long-term low level microwave irradiation of rats. *Bioelectromagnetics* 13:469-496.

Czyz J et al, 2004. High frequency electromagnetic fields (GSM signals) affect gene expression levels in tumor suppressor p53-deficient embryonic stem cells. *Bioelectromagnetics* 25: 296-307.

**DAVID CARPENTER
EXHIBIT B**

Dasdag, S et al, 1999. Whole-body microwave exposure emitted by cellular phones and testicular function of rats. *Urological Research* 27(3):219-223.

D'Costa, H et al. 2003. Human brain wave activity during exposure to radiofrequency field emissions from mobile phones. *Australasian Physical & Engineering Sciences in Medicine*, Vol. 26, No. 4

De Pomerai, D et al, 2000. Non-thermal heat-shock response to microwaves. *Nature* 405: 417-418.

D'Inzeo, G et al, 1988. Microwave effects on acetylcholine-induced channels in cultured chick myotubes. *Bioelectromagnetics* 9: 363-372.

De Iuliis GN, Newey RJ, King BV, Aitken RJ. 2009. Mobile phone radiation induces reactive oxygen species production and DNA damage in human spermatozoa in vitro. *PLoS One* 4(7):e6446.

Dolk, H et al, 1997. Cancer incidence near radio and television transmitters in Great Britain. *American Journal of Epidemiology* 145(1): 1-9.

Dumansky, JD & Shandala, MG, 1974. The biological action and hygenic significance of electromagnetic fields of superhigh and ultrahigh frequencies in densely populated areas. In: *Biological Effects and Health Hazards of Microwave Radiation. Proceedings of an International Symposium*, Czernski, P et al, (Eds) Warsaw, 15-18 October 1973, Polish Medical Publishers.

Dutta, SK et al, 1989. Radiofrequency radiation-induced calcium ion efflux enhancement from human and other neuroblastoma cells in culture. *Bioelectromagnetics* 10: 197-202.

Elekes, E, 1996. Effect on the immune system of mice exposed chronically to 50 Hz amplitude-modulated 2.45 GHz microwaves. *Bioelectromagnetics* 17:246-248.

Eltiti S, Wallace D, Ridgewell A, Zougkou K, Russo R, Sepulveda F, Mirshekar-Syahkal D, Rasor P, Deeble R, Fox E. 2007. Does short-term exposure to mobile phone base station signals increase symptoms in individuals who report sensitivity to electromagnetic fields? A double-blind randomized provocation study. *Environ Health Perspect* 115(11): 1603-8.

Eltiti S, Wallace D, Ridgewell A, Zougkou K, Russo R, Sepulveda F, Fox E. 2009. Short-term exposure to mobile phone base station signals does not affect cognitive functioning or physiological measures in individuals who report sensitivity to electromagnetic fields and controls. *Bioelectromagnetics* 30(7):556-63.

DAVID CARPENTER
EXHIBIT B

Federal Communications Commission, 1997. OET Bulletin 65: 1997-01

Fesenko, EE et al, 1999. Microwaves and cellular immunity. I. Effect of whole body microwave irradiation on tumor necrosis factor production in mouse cells. *Bioelectrochemistry and Bioenergetics* 49 (1): 29-35.

Fragopoulou AF, Koussoulakos SL, Margaritis LH. 2010. Cranial and postcranial skeletal variations induced in mouse embryos by mobile phone radiation. *Pathophysiology*. 17(3): 169-77.

Garaj-Vrhovac, V et al, 1999. Micronucleus assay and lymphocyte mitotic activity in risk assessment of occupational exposure to microwave radiation. *Chemosphere* 39 (13) 2301-2312.

Grundler W, Kaiser F, Keilmann F, Walleczek J. 1992. Mechanisms of electromagnetic interaction with cellular systems. *Naturwissenschaften* 79(12):551-9.

Gul A, Celebi H, Uğraş S. 2009. The effects of microwave emitted by cellular phones on ovarian follicles in rats. *Arch Gynecol Obstet*. 280(5):729-33,

Hamblin, D. et al, 2004. Examining the effects of electromagnetic fields emitted by GSM mobile phones on human event-related potentials and performance during an auditory task. *Clinical Neurophysiology* 115:171-178.

Hamnerius, Y, 2000. Microwave exposure from mobile phones and base stations in Sweden. International Conference on Cell Tower Siting, June 7-8, 2000, Sponsored by the University of Vienna & Land Salzburg, Salzburg, Austria.

Heinrich S, Thomas S, Heumann C, von Kries R, Radon K. 2010. Association between exposure to radiofrequency electromagnetic fields assessed by dosimetry and acute symptoms in children and adolescents: a population based cross-sectional study. *Environ Health* 9:75.

Hjollund NH, Bonde JP, Skotte J, 1997 Semen analysis of personnel operating military radar equipment. *Reprod Toxicol* 11(6):897

Hocking, B et al, 1996. Cancer incidence and mortality and proximity to TV towers *Medical Journal of Australia* 165(11-12): 601-605.

Hocking, B et al, 2000. Decreased survival for childhood leukemia in proximity to TV towers. Poster presented at the Annual Scientific Meeting of the Royal Australian College of Physicians in Adelaide, SA, Australia, May 2000.

DAVID CARPENTER
EXHIBIT B

Huber, R et al, 2002. Electromagnetic fields, such as those from mobile phones alter regional cerebral blood flow and sleep and waking EEG. *J. Sleep Res.* 11: 289-295.

Hutter HP, Moshhammer H, Wallner P, Kundi M. 2006. Subjective symptoms, sleeping problems, and cognitive performance in subjects living near mobile phone base stations, *Occup. Environ. Med.* 63. 307-313.

IEEE, 1999. C95: 1-1999(US)

Ilhan A, Gurel A, Armutcu F, Kamisli S, Iraz M, Akyol O, Ozen S. 2004, Ginkgo biloba prevents mobile phone-induced oxidative stress in rat brain. *Clin Chim Acta.* 340(1-2): 153-162.

Ilhan, A et al. 2004. Ginkgo biloba prevents mobile phone-induced oxidative stress in rat brain. *Clinica Chimica Acta* 340, 153-162.

Ivaschuk, OI et al, 1997. Exposure of nerve growth factor-treated PC 12 rat pheochromocytoma cells to a modulated radiofrequency field at 836.55 MHz: effects on c-jun and c-fos expression. *Bioelectromagnetics* 18 (3): 223-229.

Kesari KK, Behari J. 2012 Evidence for mobile phone radiation exposure effects on reproductive pattern of male rats: Role of ROS. *Electromagn Biol Med.* 31(3):213-22,

Khurana VG, Hardell L, Everaert J, Bortkiewicz A, Carlberg M, Ahonen M. 2010. Epidemiological evidence for a health risk from mobile phone base stations. *Int J Occup Environ Health.* 16(3):263-267.

Koivisto, M et al, 2000a. Effects of 902 MHz electromagnetic field emitted by cellular telephones on response times in humans. *Neuroreport* 11: 413-415.

Koivisto, M et al, 2000b. The effects of electromagnetic field emitted by GSM phones on working memory. *Neuroreport* 11:1641-1643.

Kolodynski, AA, & Kolodynska VV, 1996. Motor and psychological functions of school children living in the area of the Skrunda radio location station in Latvia. *Science of the Total Environment* 180:87-93.

Krause, CM et al, 2000. Effects of electromagnetic field emitted by a cellular phone on the EEG during a memory task. *Neuroreport* 11:761-764.

Kues, HA et al, 1992. Increased sensitivity of the non-human primate eye to radiation following ocular drug pretreatment. *Bioelectromagnetics* 13:379-393.

Kumar S Behari J Sisodia R. 2012. Impact of Microwave at X-Band in the aetiology of male infertility. *Electromagnetic Biology and Medicine*, 31(3): 223-232. online DOI: 10.3109/15368378.2012.700293.

**DAVID CARPENTER
EXHIBIT B**

Kundi M, Hutter HP. 2009. Mobile phone base stations—Effects on wellbeing and health. *Pathophysiology* 16 123–135.

Kwee, S et al, 1997. The biological effects of microwave radiation. *Proceedings of the Second World Congress for Electricity and Magnetism in Biology and Medicine*, Bologna, Italy, June 1997.

Kwee, S et al, 2001. Changes in cellular proteins due to environmental non-ionizing radiation. I. Heat-shock proteins. *Electro-and Magnetobiology* 20:141-152.

Lai H, & Singh, NP, 1996. Single and double strand DNA breaks in rat brain cells after acute exposure to radiofrequency electromagnetic radiation. *International Journal of Radiation Biology* 69:513-21.

Lass, J et al, 2002. Effects of 7 Hz-modulated 450 MHz electromagnetic radiation on human performance in visual memory tasks. *Int. J. Radiat. Biol.* 73(10): 937-944.

Lebedeva NN et al, 2000. Cellular phone electromagnetic field effects on bioelectric activity of human brain. *Crit Rev Biomed Eng* 28(1-2) 323-337.

Leszczynski, D et al, 2002. Non-thermal activation of the hsp27/p38MAPK stress pathway by mobile phone radiation in the human endothelial cells: Molecular mechanism for cancer- and blood-brain barrier-related effects. *Differentiation* 70: 120-129.

Leszczynski, D et al, 2004. Proteomics analysis of human endothelial cell line EA.hy926 after exposure to GSM 900 radiation. *Short Communication. Proteomics* 4, 1359-1365.

Lu, ST et al, 1999. Ultrawide-band electromagnetic pulses induced hypotension in rats. *Physiology and Behavior*, 67:753-761.

Magras, IN & Zenos, TD, 1997. RF Radiation-induced changes in the prenatal development of mice. *Bioelectromagnetics* 18:455-461.

Mann, K et al, 1996. Effects of pulsed high-frequency electromagnetic fields on human sleep. *Neuropsychobiology* 33:41-47.

Mann, K et al, 1998. Effects of pulsed high-frequency electromagnetic fields on the neuroendocrine system. *Neuroendocrinology* 67: 139-144.

Mantiply, ED et al, 1997. Summary of measured radiofrequency electric and magnetic fields (10 kHz to 30 GHz) in the general and work environment. *Bioelectromagnetics* 18: 563-577.

Markova E, Hillert L, Malmgren L, Persson BRR, Belyaev IY. 2005. Microwaves from GSM mobile telephones affect 53BP1 and γ-H2AX foci in human lymphocytes from hypersensitive and healthy persons. *Environmental Health Perspectives* Vol 113: No. 91 1172-1177

**DAVID CARPENTER
EXHIBIT B**

Marinelli, F La Sala D Cicciotti G Cattini L Trimarchi C Putti S Zamparelli A Giuilani L Tomassetti G Cinti C. 2004. Exposure to 900 MHz Electromagnetic Field induces an unbalance between pro-apoptotic and pro-survival signals in T-lymphoblastoid leukemia CCRF-CEM cells. *Journal of Cellular Physiology* 198: 324 – 332.

Mohler E, Frei P, Braun-Fahrlander C, Fröhlich J, Neubauer G, Rösli M; Qualifex Team. 2010. Effects of everyday radiofrequency electromagnetic-field exposure on sleep quality: a cross-sectional study. *Radiat Res* 174(3):347-56.

Oberfeld, G Enrique, NA Manuel P Ceferino M Gomez-Perretta C. 2004. The Microwave Syndrome – Further Aspects of a Spanish Study. 3rd International Workshop on Biological Effects of Electromagnetic Fields. Kos, Greece.

Otitoloju AA, Obe IA, Adewale OA, Otubanjo OA, Osunkalu VO. 2010. Preliminary study on the induction of sperm head abnormalities in mice, *Mus musculus*, exposed to radiofrequency radiations from global system for mobile communication base stations. *Bulletin of Environmental Contamination and Toxicology* 84(1):51-4.

Navakatikian, MA & Tomashevskaya, LA, 1994 Phasic behavioral and endocrine effects of microwaves of nonthermal intensity. In: *Biological Effects of Electric and Magnetic Fields*, Volume 1, Carpenter, DO, (Ed.) Academic Press, Inc., San Diego, CA., pp. 333-342.

Navarro EA, Sequera J, Portoles M, Gomez-Perretta de Mateo C. 2003. The Microwave Syndrome: A Preliminary Study in Spain. *Electromag Biol Med* 22:161-169,

Novoselova, FG et al, 1999. Microwaves and cellular immunity. II Immunostimulating effects of microwaves and naturally occurring antioxidant nutrients. *Bioelectrochemistry and Bioenergetics* 49 (1): 37-41.

Panagopoulos DJ. 2012. Effect of microwave exposure on the ovarian development of *Drosophila melanogaster*. *Cell Biochem Biophys*. 63(2):121-132,.

Paulraj R, Behari J. 2004. Radio frequency radiation effects on protein kinase C activity in rats' brain. *Mutat Res*. 545(1-2):127-130,

Persson, RR et al, 1997. Blood-brain barrier permeability in rats exposed to electromagnetic fields used in wireless communication. *Wireless Networks* 3:455-461.

Paredi P et al, 2001. Local Vasodilator Response to Mobile Phones. *Laryngoscope* 111: 159-162.

Phillips, J et al, 1998. DNA damage in molt-4 lymphoblastoid cells exposed to cellular telephone radiofrequency fields in vitro. *Bioelectrochemistry and Bioenergetics* 45:103-110.

DAVID CARPENTER
EXHIBIT B

Preece, A et al, 1999. Effect of a 915-MHz simulated mobile phone signal on cognitive function in man. *International Journal of Radiation Biology* 75: 447-456.

Pyrpasopoulou, A et al, 2004. Bone morphogenetic protein expression in newborn rat kidneys after prenatal exposure to radiofrequency radiation. *Bioelectromagnetics* 25: 216-227.

Ray, S & Behari, J, 1990. Physiological changes in rats after exposure to low levels of microwaves. *Radiation Research* 123: 190-202.

Repacholi, M. et al, 1997. Lymphomas in *Eμ-Pim1* transgenic mice exposed to pulsed 900 MHz electromagnetic fields. *Radiation Research* 147:31-40.

Richter, E et al, 2000. Cancer in radar technicians exposed to radiofrequency/microwave radiation: sentinel episodes. *International Journal of Occupational Health* 6(3): 187-193.

Riddervold IS, Pedersen GF, Andersen NT, Pedersen AD, Andersen JB, Zachariae R, Mølhave L, Sigsgaard T, Kjaergaard SK. 2008. Cognitive function and symptoms in adults and adolescents in relation to RF radiation from UMTS base stations. *Bioelectromagnetics* 29(4):257-67.

Sage Associates, 2004. An Overview of Low-Intensity Radiofrequency/Microwave Radiation Studies Relevant to Wireless Communications and Data. *Bioelectromagnetics Society Annual Meeting*, Washington DC, June 2004.

Sage Associates, 2004. Epidemiology for Decisionmakers: A Visual Guide to Residential and Occupational EMF Epidemiological Results on Leukemia 1979-2004. International Conference on Leukemia, London, September 2004. Children with Leukemia Trust (UK Registered Charity No. 298405).

Sage Associates, 2000. An overview of radiofrequency/microwave radiation studies relevant to wireless communications and data. International Conference on Cell Tower Siting, Salzburg, Austria, Land Salzburg-Landessanitätsdirektion -- Umweltmedizin, Federal State of Salzburg Public Health Department, Environmental Health Unit, June 7-8, 2000.

Salama N, Kishimoto T, Kanayama HO. 2010. Effects of exposure to a mobile phone on testicular function and structure in adult rabbit. *Int J Androl*. 33(1):88-94.

Salford, LG et al. 1994. Permeability of the blood brain barrier induced by 915 MHz electromagnetic radiation, continuous wave and modulated at 8, 16, 50 and 200 Hz. *Microscopy Research and Technique* 27:535-542.

Salford, LG et al, 2003. Nerve cell damage in mammalian brain after exposure to microwaves from GSM mobile phones. *Environmental Health Perspectives Online* January 29.

DAVID CARPENTER
EXHIBIT B

Sandstrom M et al, 2001. Mobile phone use and subjective symptoms. Comparison of symptoms experienced by users of analogue and digital mobile phones. *Occup Med* 51(1): 25-35.

Santini R et al, 2001. Symptômes rapportés par des utilisateurs de téléphones mobiles cellulaires. *Path Biol* 49:222-226.

Sarimov, R., Malmgren, L.O.G., Markova, E., Persson, B.R.R., Belyaev, I.Y. 2004. Nonthermal GSM microwaves affect chromatin conformation in human lymphocytes similar to heat shock. *IEEE Trans Plasma Sci* 32:1600-1608,

Schirmacher, A et al, 2000. Electromagnetic fields (1.8 GHz) increase the permeability of sucrose of the blood-brain barrier in vitro. *Bioelectromagnetics* 21:338-345.

Schmidt M Murbach M Inelustenberger C Maire M Kuster N Achermann P. s2012. Sleep EEG alterations: effects of pulsed magnetic fields versus pulse-modulated radio frequency electromagnetic fields. *J. Sleep Research, European Sleep Research Society* DOI: 10.1111/j.1365-2869.2012.01025.x.

Schwartz, JL et al, 1990. Exposure of frog hearts to CW or amplitude-modulated VHF fields: selective efflux of calcium ions at 16Hz. *Bioelectromagnetics* 11(4): 349-358.

Seaman, RL et al, 1999. Hyperactivity caused by nitric oxide synthase inhibitor is countered by ultra-wide band pulses. *Bioelectromagnetics* 20: 431-439.

Somogyi, Z et al, 1991. Effects of modulated and continuous microwave irradiation on the morphology and cell surface negative charge of 3T3 fibroblasts. *Scanning Microsc* 5(4): 1145-1155.

Somogyi, Z et al, 1993. Effects of modulated and continuous microwave irradiation on pyroantimonate precipitable calcium content in junctional complex of mouse small intestine. *Scanning Microsc* 7(4): 1255-1261.

Stagg RB et al, 1997. DNA synthesis and cell proliferation in C6 glioma and primary glial cells exposed to 836.55 MHz modulated radiofrequency field. *Bioelectromagnetics* 18(3):230-236.

Stang A et al, 2001. The possible role of radiofrequency radiation in the development of uveal melanoma. *Epidemiology* 12(1):7-12.

Stankiewicz W, Dąbrowski MP, Kubacki R, Sobiczewska E, Szmigielski S. 2006. Immunotropic Influence of 900 MHz Microwave GSM Signal on Human Blood Immune Cells Activated in Vitro. *Electromagnetic Biology and Medicine* 25(1) 45-51.

Stark KD et al, 1997. Absence of chronic effect of exposure to short-wave radio broadcast signal on salivary melatonin concentrations in dairy cattle. *J Pineal Res* 22(4):171:176.

DAVID CARPENTER
EXHIBIT B

Sun W, Shen X, Lu D, Fu Y, Chiang H. 2012. A 1.8-GHz radiofrequency radiation induces EGF receptor clustering and phosphorylation in cultured human amniotic (FL) cells. *Int J Radiat Biol* 88(3):239-44.

Szmigielski, S et al, 1982. Accelerated development of spontaneous and benzo(a)pyrene-induced skin cancer in mice exposed to 2350 MHz microwave radiation. *Bioelectromagnetics* 3: 179-192.

Tattersall, JE et al, 2001. Effects of low intensity radiofrequency electromagnetic fields on electrical activity in rat hippocampal slices. *Brain Res* 904(1): 43-53.

Thomas S, Kühnlein A, Heinrich S, Praml G, Nowak D, von Kries R, Radon K. 2008. Personal exposure to mobile phone frequencies and well-being in adults: a cross-sectional study based on dosimetry. *Bioelectromagnetics* 29:463-470.

Thomas S, Heinrich S, von Kries R, Radon K. 2010. Exposure to radio-frequency electromagnetic fields and behavioural problems in Bavarian children and adolescents. *Eur J Epidemiol* 25(2):135-41.

TNO Physics and Electronics Laboratory, The Netherlands. 2003. Effects of Global Communication System radio-frequency fields on well-being and cognitive functions of human beings with and without subjective complaints. Netherlands Organization for Applied Scientific Research 1-63.

Trosic, I et al, 2002. Micronucleus induction after whole-body microwave irradiation of rats. *Mutation Research* 521: 73-79.

Velizarov, S et al, 1999. The effects of radiofrequency fields on cell proliferation are non-thermal. *Bioelectrochemistry and Bioenergetics* 48: 177-180.

Veyret, B et al, 1991. Antibody responses of mice exposed to low-power microwaves under combined, pulse and amplitude modulation. *Bioelectromagnetics* 12: 47-56.

Weisbrot, D et al, 2003. Effects of mobile phone radiation on reproduction and development in *Drosophila melanogaster*. *Journal of Cellular Biochemistry* 89: 48-55.

Wolke, S et al, 1996. Calcium homeostasis of isolated heart muscle cells exposed to pulsed high-frequency electromagnetic fields. *Bioelectromagnetics* 17(2): 144-153.

Yan JG, Agresti M, Bruce T, Yan YH, Granlund A, Matloub HS. 2007. Effects of cellular phone emissions on sperm motility in rats. *Fertility and Sterility* 88(4):957-64.

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Requests: Cindy Sage, Sage Associates (sage@silcom.com)

EXPERT REPORT

Re: Friedman vs. Central Maine Power Company

2:20-cv-00237-JDL

David O. Carpenter, MD

Qualifications:

My name is David O. Carpenter. I am a public health physician and professor, with a medical degree from Harvard Medical School. My current title is Director of the Institute for Health and the Environment at the University at Albany, which has been designed as a Collaborating Centre of the World Health Organization, as well as Professor of Environmental Health Sciences within the School of Public Health. In addition I am an Honorary Professor, Queensland Children's Medical Research Unit, University of Queensland, Brisbane, Australia. Formerly, I was the Director of the Wadsworth Center for Laboratories and Research of the New York State Department of Health (1980-1985) and the Dean of the School of Public Health at the University of Albany (1985-1998), while remaining employed by the New York State Department of Health. I assumed my current position in 1998.

In the 1980s I served as Executive Secretary of the New York State Powerlines Project, a state-funded study designed to determine whether there were adverse health effects from living near power lines. The program of research showed children living in homes with elevated magnetic fields coming from power lines suffered from an elevated risk of developing leukemia, and that electromagnetic field (EMF) exposure altered a variety of responses studied in animals and in cellular systems. After the Powerlines Project was finished, I became the spokesperson for New York State on the issue of health effects of electromagnetic fields.

I have published several reviews and have edited two books on the Biologic Effects of Electric and Magnetic Fields. I am also a Co-Editor and a Contributing Author of the *BioInitiative Report: A Rationale for a Biologically-based Public Exposure Standards for Electromagnetic Fields (ELF and RF)* (www.bioinitiative.org). This report was first published in 2007, and has been updated in 2012 and 2014. The *BioInitiative Report* documents effects on cellular and animals model systems, adverse human health effects and public health conclusions about impacts of electromagnetic radiation [electromagnetic fields including extremely-low frequency (ELF-EMF) and radiofrequency /microwave (RF/MW-EMF) fields]. I will refer to specific sections of the report where appropriate. I also reference the entire report as a comprehensive and up-to-date review of the scientific information on this subject.

Attached as Exhibit A is my *curriculum vitae*. I am an active researcher and educator. My research activities at present are focused on the general subject of environmental causes of human disease. I have authored over 460 major publications in peer-reviewed scientific journals, have edited six books and have numerous other publications as listed in my *curriculum vitae*. I participate in many international, national, state and local organizations and committees as listed in my *curriculum vitae* along with the Honors, Awards, and Fellowships I have received. I have had sufficient research, administrative and evaluation responsibilities related to human health effects of power line magnetic fields so as to be known as an international expert in this field. In 2009, I was invited to present to the United States President's Cancer Panel on the subject of

power line and radiofrequency fields and cancer. This invitation was based on recognition that I am an expert on this subject. In addition I was invited to testify on the more general issue of adverse health effects resulting from human exposure to electromagnetic fields before the United States House of Representatives. This invitation was based on my reputation as being an expert on this subject. I have also testified on the specific subject of adverse health effects resulting from exposure to magnetic fields arising from power lines. In recent cases I was certified by the courts to be qualified as an expert for health effects of magnetic fields coming from power lines (State of New Jersey, Board of Public Utilities, BPU Docket No. EO16080750; OAL Docket No. PUC 12098-16; 6/22/2018) and radiofrequency electromagnetic fields (US District Court, District of Massachusetts, Civil Action No. 4:15-CV-40116-TSH; 12/8/2015).

This Case:

Mr. Ed Friedman suffers from a form of non-Hodgkin's Lymphoma, called Waldenstrom's macroglobulinemia. This is in general not a curable disease although progression can be delayed with treatment. Mr. Friedman, as well as other residents of Maine, had opposed the installation of RF-emitting smart meters as replacement of analog meters which require someone to read the degree of electrical usage. The courts ruled that Central Maine Power (CMP) could install smart meters, but when an individual requested for any reason, to opt-out of having one placed on their home, they could do so, but would be charged an opt-out fee in addition to the regular electrical usage bill. Mr. Friedman is challenging the right of Central Maine Power to force him to pay surcharges under the American's With Disabilities Act (ADA), Fair Housing Act (FHA) and Rehabilitation Act (RA), based on his cancer, for the same safe power his non-disabled neighbors receive without an extra surcharge. Prior to his disconnection by CMP, he did pay his usage bill. Were they to reconnect him, he requests relief from the discriminatory surcharge because of his cancer. The risk of exacerbating his cancer from 24/7 smart meter exposure means he does not have an option to opt-out as one might with other objections to smart meters but instead has a necessity to avoid the smart meter.

The Americans with Disabilities Act (as well as FHA and RA) are designed to prevent discrimination against individuals who suffer from any disability for which the usual scope of business or other activity would put the disabled person at a disadvantage. The ADA also specifically prohibits imposition of a surcharge on an individual with a disability in order for that individual to avoid the discriminating action. (The FHA specifically cites discrimination in the provision of services and the RA prohibits discrimination for any recipient of federal funding like CMP.) In this case that action is for Mr. Friedman to avoid the likely exacerbating effects of exposure to radiofrequency EMFs that would occur upon placement of a smart meter on his house.

Smart Meters:

There are no careful studies specifically on cancer being caused by electronic meters to my knowledge, in great part because they haven't been around very long, cancer has a long latency between exposure and disease, and all of us are exposed to multiple sources of RF. But smart meter utilize the same type of RF radiation that is used in cell phones. It should be noted that the World Health Organization has declared radiofrequency radiation (including that from smart meters) to be a possible human carcinogen. While it is true that the nature of exposure to RF from electronic meters is only somewhat different from that coming from other wireless devices,

what is important is cumulative, aggregate RF exposure. Most electronic meters transmit signals to the utility for relatively short periods of time but generate radiofrequency pulses at frequent intervals all day and night. Thus the device continuously generates modulated pulses of RF radiation that will expose anyone nearby 24/7. Besides airborne transmission emissions to the utility there is some evidence these RF emissions as well as lower frequency emissions affecting power quality, may be transmitted throughout structures as conducted and radiating emissions on building wiring, acting as an antenna.(Isotrope, 2013).

The waveform used by smart meters consists of very high intensity but very brief burst of pulses. While the average total exposure over periods of time usually do not exceed FCC standards, those standards are not set based on critical peak intensities. An analogy, illustrating the importance of peak is often made with a bullet, the force and damage from the peak impact being far more than the average force. There is building evidence that the rapid rise and fall of these RF peaks is particularly provocative to humans.

While there are not yet specific studies connecting smart meters directly to cancer, there have long been studies showing DNA damage from exposure to RF including at 2450MHz (Lai and Singh 1995), the same frequency used by CMP smart meters. DNA damage is often a precursor to cancers whether through oxidative stress (Yakemenko, et al., 2015) or other mechanisms.

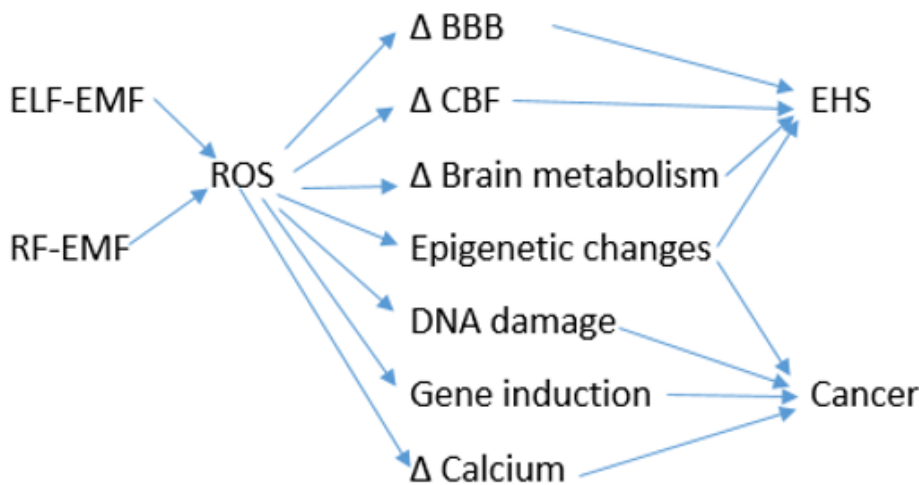
Most of the published reports on health effects specifically from smart meters are directed at the syndrome of electro-hypersensitivity (EHS). This is found in some individuals who in the presence of elevated RF-EMFs develop symptoms of fatigue, headache, brain fog, tinnitus and other symptoms that in some people can be very disabling. EHS symptoms like these and others share much in common with many cancer symptoms and cancer treatment side-effect symptoms so Mr. Friedman's concerns are well founded that RF exposure risks exacerbating some of his present symptoms. These high intensity pulses may be more provocative than continuous waves, as suggested by the report of McCarty et al. (2011), who reported on symptoms experienced by a physician who suffered from EHS, and upon testing in a doubled blinded manner, responded to the on and off of EMFs, not to the steady state.

There is also significant information on self-reported changes in health status by individuals after installation of smart meters on their homes. In a smart meter health effects survey and report submitted and accepted as expert testimony by Dr. Conrad to the Maine PUC in 2013, nearly 98% of the 210 respondents were very sure or fairly sure their new or worsened symptoms correlated with smart meter exposure. 42% of these respondents began suffering symptoms or had preexisting symptoms worsen after smart meter installation but *prior to any knowledge* the meters had been installed. Frequent symptoms included pressure in head, ringing, buzzing/tinnitus, difficulty concentrating, insomnia, heart racing, arrhythmia, headaches and fatigue. Lamech (2014) published a peer-reviewed study of 142 Australians who submitted information on a public web site on changes in health status after a smart meter was installed on their home. The most frequent symptoms were insomnia, headaches, tinnitus, fatigue and cognitive disturbances. She suggests that these individuals have developed EHS as a result of the smart meter RF EMFs. Carpenter (2015) reported on statements made by a California physician and her husband who had a smart meter placed on their home without their knowledge while they were away from home. Upon returning home both developed the symptoms of EHS, which were only later found to be due to the presence of the smart meter. The symptoms were markedly reduced after the smart meter was removed, although both persons remained at elevated sensitivity to EMFs up until the present.

Radiofrequency fields and cancer:

In 2011 IARC made the designation that exposure to radiofrequency electromagnetic fields was a “possible human carcinogen”, based primarily on studies of development of brain cancer among individuals who used mobile phones frequently for 10 years or more. One reason that RF-EMFs were not rated as “probable” or “known” human carcinogens was the lack of evidence that these exposures caused cancer in animals. This has changed since 2011 when both the US National Toxicology Program (Wyde et al., 2018) and a study from the Ramazzini Institute in Italy (Falcioni et al., 2018) have found that RF-EMFs at intensities modeled to reflect whole body exposure from cell phones (similar wattage to smart meters) and cell towers, respectively, cause malignant brain and cardiac Schwannoma cancers in rodents, and also caused DNA damage to neurons. There is a large body of evidence showing that excessive exposure to EMF of various frequencies increases risk of cancer. The evidence will not be reproduced here, but can be found in the Bioinitiative Report (www.bioinitiative.org) and the review by Belpomme et al. (2018). Regarding the possibility of cardiac Schwannomas, it must be noted that Mr. Friedman's history of coronary artery disease already compromises his heart, a risk that need not be compounded by smart meter/RF exposure.

Figure 1, below, shows what is currently understood to be the mechanisms responsible for the diverse effects of EMF exposure, both from extra-low frequency (ELF) signals and radiofrequency (RF) signals. Both generate reactive oxygen species (ROS), which are the ultimate cause of changes in the blood brain barrier (BBB), cerebral blood flow (CBF), brain metabolism, epigenetic changes, DNA damage, gene induction and changes in cellular calcium concentrations. These ultimately lead to an increased risk of cancer and of the syndrome of electro-hypersensitivity (EHS).



There is not strong evidence that Waldenström macroglobulinemia is caused by exposure to RF-EMFs, but neither is there any evidence that it is not associated with these exposures, since it has not been studied. For other cancers known to be associated with electromagnetic field exposure (childhood leukemia) there is strong evidence that among children who have been diagnosed with leukemia, survival is shortened among children with high EMF exposure as compared to those with lesser exposure (Folmar et al., 2006; Svendsen et al., 2007).

Conclusion:

Mr. Friedman is clearly disabled because of his blood cancer. While there is not strong evidence that exposure to the radiofrequency electromagnetic fields caused his cancer (and he does not make that claim), there is clear evidence that elevated exposure to electromagnetic fields shortens survival of children diagnosed with leukemia, also a blood cancer. In my expert opinion, Mr. Friedman is most certainly justified in his concern that having a smart meter installed at his home actually risks worsening his lymphoma's progression or symptoms.

I conclude with a reasonable degree of medical certainty that if a smart meter were placed on Mr. Friedman's house, the elevated exposure coming from it would increase the risk his cancer could worsen which in turn logically may exacerbate his symptoms affecting his quality of life and likely shortening it. This situation is precisely the situation that the Americans with Disabilities Act is designed to prevent by providing access equal to that of the non-disabled.



David O. Carpenter, MD

28 October 2012

References:

Belpomme D, Hardell L, Belyaev I, Burgio E and Carpenter DO (2018) Thermal and non-thermal health effects of low intensity non-ionizing radiation: An international perspective. Environ Poll 242: 643-658.

Carpenter DO (2015) The microwave syndrome or electro-hypersensitivity: Historical background. Rev Environ Health 30: 217-222.

Conrad R (2013) Exhibit D-Smart Meter Health Effects Survey & Report. Exhibit 9, Pre-filed testimony of Richard Conrad, Ph.D, MPUC Docket No. 2011-00262

Falcioni L, Bua I, Tibaldi E, Lauriola M, De Angelis L, Gnudi F, Mandrioli D, et al. (2018) Report of final results regarding brain and heart tumors in Sprague-Dawley rats exposed from prenatal life until natural death to mobile phone radiofrequency field representative of a 1.8 GHz GSM base station environmental emission. Environ Res 164: 271-279.

Foliart DE, Pollock BH, Mezei G, Iriye R, Silva JM, Ebi KL, Kheifets L, Link M, and Kavet R (2006) Magnetic field exposure and long-term survival among children with leukaemia. Br J Cancer 94; 161-164.

IARC (International Agency for Research on Cancer) (2013) Non-Ionizing Radiation, Part 2: Radiofrequency Electromagnetic Fields. IARC Monographs on the Evaluation of Carcinogenic Risks to Humans. World Health Organization.461 pp.

Isotrope Wireless LLC (2013) Report on Examination of Selected Sources of Electromagnetic Fields at Selected Residences in Hastings---on---Hudson <https://www.isotrope.im/>

<https://skyvisionsolutions.files.wordpress.com/2014/04/report-on-examination-of-selected-sources-of-emf-at-selected-residences.pdf>

Lamech F (2014) Self-reporting of symptom development from exposure to radiofrequency fields of wireless smart meters in Victoria, Australia: A case series. *Alter Therap* 20: 28-39.

Lai, H and N.P. Singh (1995), Acute low-intensity microwave exposure increases DNA single-strand breaks in rat brain cells, *Bioelectromagnetics* 16. 207–210.

McCarty DE, Carrubba S, Chesson AI, Frilot C, Conzalex-Toledo E et al. Electromagnetic hypersensitivity: Evidence for a novel neurological syndrome. *Int J Neurosci* 121: 670-676.

Svendsen AL, Weihkoph T, Kaaatsch P, Schuz J (2007) Exposure to magnetic fields and survival after diagnosis of childhood leukemia: A German cohort study. *Cancer Epidemiol Biomark Prev* 16: 1167-1171.

Yakymenko I, Tsybulin O, Sidorik E, Henshel D, Kyrylenko O, Kyrylenko S. (2015) Oxidative mechanisms of biological activity of low-intensity radiofrequency radiation. *Electromagn Biol Med*. 2016;35(2):186-202.

Wyde M, Cesta M, Blystone C, Elmore S, Foster P et al., (2018) Report of partial findings from the National Toxicology Program carcinogenesis studies of cell phone radiofrequency radiation in Hsd: Sprague Dawley SD rats (whole body exposure). *BioRxiv* 055699.